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SOME CULTIVATED RELATIVES OF THE CAMELLIA

THE great interest shown in *Camellia*, with its large and handsome flowers, evergreen leaves, and numerous cultivated forms,[1] has often tended to obscure other members of the Tea Family (Theaceae) in cultivation. Four interesting and highly ornamental species are native to the southeastern United States and other Asiatic members of the family are also in cultivation.

The Tea Family is primarily tropical in its distribution, with about 30 genera and some 500 species in the warmer parts of the Old and New World. A few species extend into cooler areas and it is primarily these which are cultivated in the United States, although more tender representatives are being grown in the milder climates of the West Coast and in the Southeastern States. The deciduous-leaved genera *Franklinia* and *Stewartia* are far hardier than most, however, and some species grow well even north of Boston.

If any generalization as to the cultivation of members of the Theaceae is permissible it would seem to be that most of these plants require acid soils and treatment similar to that accorded rhododendrons. Certainly some, as *Franklinia* and *Gordonia lasianthus*, will not grow at all without these conditions. Various early failures with the plants in England probably stem from lack of knowledge of this factor. Notes on specimens collected in Asia are few, but habitats and associates all suggest that Theaceae seldom occupy calcareous areas.

The notes which follow are an attempt to draw together some of the scattered information about those groups which are reported to be under cultivation in the United States at the present time. Some of these are currently misidentified in the nursery trade and for many there do not seem to be good modern records concerning the areas in which they are cultivated, their hardiness, or special cul-

[1] One Florida nursery alone lists some 375 cultivars!

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ture. Further information along these lines, or the presence of other species in the United States, will be most appreciated additions to this preliminary report.

We are also anxious to add documenting herbarium specimens of cultivated Theaceae to the Arboretum's collections. Dr. C. E. Kobuski, Curator of the Arnold Arboretum and the Gray Herbarium, and a specialist on the classification of the family, is willing to identify members of the Theaceae, with the exception of *Camellia*.

I should like especially to express my appreciation to Dr. Kobuski for his kind and generous aid in the preparation of this paper. In addition, much of the information included here is drawn from his excellent series of monographic studies of this complex and variable family. The accompanying plate was drawn by Mrs. Dorothy Marsh in connection with work on the plants of the southeastern United States.

The members of the Tea Family are trees or shrubs with simple, alternate, usually evergreen leaves which lack stipules. The flowers are often showy and are regular in their floral symmetry. The sepals and petals are normally five, but there are usually two or more bracts beneath the sepals and, in some groups (e.g. *Gordonia axillaris* and *Camellia*), the spirally arranged bracts grade into the sepals and these into petals. Extra petals are sometimes present (as in some Stewartias) and "double" forms of *Camellia* provide excellent examples of the conversion of stamens into extra petals. The sepals are overlapping in the bud in a characteristic fashion, with two sepals completely outside the others, two completely inside, and one with one edge inside and one outside. The petals are usually joined at their bases and the numerous stamens are attached to the petals, so that both fall together. The stamens are often in groups at the base of each petal or their filaments may be united at their bases to form a ring. The fruits and seeds are frequently characteristic and provide good bases for the classification of the group, a matter which is frustrating to one who would use the flowering state for identification. However, many of the characteristics of the fruit may be determined from the examination of the pistil: the number of styles (1–5), the number of cells (locules or compartments) within the ovary (1–3–4–5), and the number of ovules (1–many), the shape of the ovary, etc. The following key attempts to use as many flowering and fruiting characteristics as possible to enable identification of the eight genera in the United States. It should be noted that only plants known to be cultivated out-of-doors have been included and that the key may not work for other species of some of the genera. *Camellia* enthusiasts may be disappointed to find no mention of their favorite genus beyond the key. They will immediately agree, however, that theirs is a complex group of cultivated plants far beyond the scope of this article and the author will even more readily admit the group to be far beyond his knowledge.

Key to Genera of Theaceae Cultivated in the United States[2]

A. Fruit a regularly dehiscent capsule; flowers an inch or more in diameter, usually large and showy; stamens very numerous, the anthers versatile (except in *Schima*); ovary 5-celled (or 3-celled in Camellia), usually pubescent. CAMELLIA tribe.

B. Seeds conspicuously winged, either at one end or marginally; capsule loculicidally dehiscent, with a persistent central axis; sepals suborbicular, persistent at least into young fruit.

C. Capsule elongate, ovoid to elliptic; seeds usually 4 or more per locule, with a pronounced oblong wing at the upper end. . . . 1. *Gordonia*.

C. Capsule globose or subglobose; seeds usually 3 per locule, kidney-shaped, with a conspicuous, thin, marginal wing. . . . . 2. *Schima*.

B. Seeds wingless (or in 1 sp. of *Stewartia* with a narrow, thinner margin); capsule with or without a persistent central axis; sepals persistent or deciduous.

D. Ovary usually 3-celled; seeds large, plump, tending to be spherical, but angled through mutual pressure, 1–3 in each cell; capsule loculicidal, with a persistent central axis; petals red to white or yellow. *Camellia* (including *Thea*).

D. Ovary 5-celled; seeds 1–10 in each cell of the capsule; petals white.

E. Capsule globose, dehiscing loculicidally from above and septicidally from below, with a persistent central axis; sepals suborbicular, dehiscent at or soon after anthesis; stamens in 5 conspicuous clusters, the filaments free to the base. . . . . 3. *Franklinia*.

E. Capsule dehiscing loculicidally from above only, a central axis absent, sepals ovate to oblong-ovate, persistent into fruit; filaments of stamens united toward the base in a ring. . . . . 4. *Stewartia*.

A. Fruit fleshy, berry-like, not regularly dehiscent; flowers less than 1 inch in diameter; anthers basifixed; ovary 2–3-celled, glabrous; leaves evergreen. TERNSTROEMIA Tribe.

F. Flowers perfect; stamens about 25–60; flowers more than $\frac{1}{4}$ inch wide; leaves (in ours) entire.

G. Leaves spirally arranged, clustered near the tips of the branches; ovary 2-celled, each cell with 2–5 ovules; fruit red, few-seeded; stamens about 60, the anthers glabrous. . . . . 5. *Ternstroemia*.

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[2] The terms used here are all included in Dr. Kobuski's "A Revised Glossary of the More Common Botanical and Horticultural Terms," Arnoldia **15**: (5–7) 25–44, 1955.

G. Leaves alternate, more or less 2-ranked; ovary 2–3-celled, with numerous ovules in each cell; fruit black, many-seeded; stamens about 25, the anthers hispid. . . . . 6. *Cleyera.*

F. Flowers unisexual; staminate and pistillate flowers on different plants; flowers small, about $\frac{1}{4}$ inch high; styles 3-parted; ovules and seeds numerous; stamens 10–15, the anthers glabrous: fruit a small, black berry. 7. *Eurya.*

1. **Gordonia** Ellis, 1771. (Named in honor of James Gordon, 1728–1791, a nurseryman at Mile-End, near London, "to whom the science of Botany is highly indebted, and whose merit is universally known for his great knowledge in the cultivation of exotic plants.")

A genus of about 30 species, one in the southeastern U.S. and the others in the warmer parts of southeastern Asia. Our native species, *G. lasianthus*, is a very distinctive species with handsome, fragrant, white flowers. The bases of the stamens are united to form conspicuous fleshy pads which are united in a ring. The plant is native from eastern North Carolina, south to the region of Lake Okeechobee, Florida, and west along the Gulf of Mexico to Mississippi, always in acid, peaty soils of non-alluvial branch- and creek-swamps, "pocosins," hammocks, "bays," sand-hill bogs, etc. Flowering from July and August, the plant is a handsome tree, sometimes cultivated. It was first grown in England about 1768 and was described from living specimens, as well as from herbarium specimens sent by Alexander Garden from Charleston, S.C. It is hardy as far north as Philadelphia, where it flowers and fruits in the garden of Mrs. J. Norman Henry, at Gladwyne. Under favorable conditions in the wild the plant may reach 75 feet in height and more than 20 inches in diameter. Like many of its relatives, however, it may flower when a small shrub.

PLATE I. Genera of Theaceae native to the United States. 1–7. *Franklinia alatamaha.* 1. Fruiting branch prior to flowering, bearing fruit of two preceding years, ×1/6; 2. Bud, showing outermost sepal and two bracteoles, ×2/3; 3. Flower, ×1/3; 4. Petal with group of stamens attached, ×2/3; 5. Pistil, ×1; 6. Old fruit from which seeds have been shed, ×1; 7. Seed, ×2.

8–13. *Gordonia lasianthus.* 8. Tip of flowering branch, ×1/3; 9. Bud with four bracteoles, ×2/3; 10. Petal with stamens attached, ×2/3 (note fleshy pad composed of united bases of stamens); 11. Calyx and pistil, the outermost sepal removed, ×1; 12. Fruit from which seeds have been shed, ×1; 13. Winged seed, ×2.

14–17. *Stewartia ovata* var. *grandiflora.* 14: Flowering branch, 6–7-petaled form, ×1/3; 15. Flower, 5-petaled form, ×1/3; 16. Loculicidal capsule, partly opened, with persistent calyx, ×1; 17. Seed, ×2. (Plate drawn by Mrs. Dorothy Marsh, 1956. Figs. 1, 6, 7, 12 from cultivated plants at the Henry Foundation for Botanical Research, Gladwyne, Pa. Figs. 8–11 from materials collected by Drs. R. B. Channell and H. F. L. Rock in Bladen County, N.C.; Fig. 13 from a herbarium specimen from Brunswick Co., N.C. Remaining figures from plants in the living collections of the Arnold Arboretum, Jamaica Plain.)

PLATE I

The Asiatic members of the genus, which have sessile flowers, in contrast with ours, and in which the bracts tend to grade into sepals and sepals into petals, are plants of tropical and subtropical southeastern Asia. *Gordonia axillaris*, a very handsome shrub or tree, is cultivated at least on the California coast, and may be grown as a tender shrub in the Deep South.

Gordonia is interesting as a formerly widespread genus now restricted to the southeastern United States and southeastern Asia. Fossil Gordonias are known from Europe and the western United States.

2. **Schima** Blume, 1825. (Name not explained.)

According to the latest monographer the genus consists of a single highly variable species, *S. wallichii*, with nine subspecies which occur in the Bonin Islands, the Liu-Kiu Islands, southern China, northern Burma, eastern India, Malaya, and the East Indies, at altitudes from 15 feet to 10,000 feet above sea-level. The tree may grow to be 150 feet tall and four feet in diameter. The fragrant white flowers up to more than two inches in diameter are very similar in appearance to those of *Gordonia* and are peduncled like those of *G. lasianthus*. As in other Theaceae, the flowers are in the axils of leaves or, in this species, bracts, representing reduced leaves, near the tips of the branches. This reduction in leaf-size may give the appearance of a short raceme, but a strange raceme, in that it may later grow on vegetatively. *Schima* is reported to be in cultivation in southern California, but I have seen no specimens and do not know to what subspecies these plants belong. The wide altitudinal range of the species suggests that it might be possible to select hardier forms of this handsome evergreen tree.

Schima and *Gordonia* are similar in general structure but are easily distinguished by their very different fruits and seeds.

3. **Franklinia** Marshall, 1785. (Named as a compliment to Benjamin Franklin, American philosopher and statesman, 1706–1790.)

Only a single species, *F. alatamaha*, and this now known only in cultivation. It was formerly known only from an area of two or three acres of "sand-hill bog" or "branch-swamp" at the edge of sandhills near Fort Barrington, on the Altamaha (then spelled "Alatamaha") River, in McIntosh County, Georgia, where it was first seen by John Bartram and his son, William, on October 1, 1765. The species was last seen at this spot by Moses Marshall, a nephew of Humphry Marshall, in 1790. It has not been found again in the wild in spite of repeated searches dating from about 1881. *Franklinia* has been cultivated in England since about 1774, however, and it is known that, in 1777, William Bartram collected at Fort Barrington ripe seeds from which were grown plants which flowered in four years at Philadelphia. Most of the plants in cultivation in the United States are thought to be descendants of a plant rescued by the Meehans of Philadelphia from Bartram's then neglected garden some years before it was taken over by the

PLATE II

The fragrant white flowers of *Franklinia alatamaha* are borne on plants at the Arnold Arboretum from late August or early September until frost.

city of Philadelphia. Attempts on the part of Humphry and Moses Marshall to fill large orders for *Franklinia* plants placed by a London firm in 1787 and 1789 may well have played a fatal part in the extinction of the colony at Fort Barrington.

As a cultivated plant the large, white, rose-scented flowers with their conspicuous orange stamens are usually produced from July (or, in the North, from late August or September) until frost. According to Bartram, however, at Fort Barrington the plant flowered from "April untill the autumn when it ceases flowering, whilst the seed of the flowers of the preceding year are ripening," and at Thomasville, Georgia, it is reported to flower in April and May. The plant is further valued for its brilliant crimson autumn coloration. In spite of its extremely limited area on the coastal plain of Georgia, the plant is hardy as far north as Boston, flourishing in acid soils which are a prerequisite to its cultivation. At the Arnold Arboretum it is grown as a many-stemmed shrub, around the base of which soil may be placed in winter as added root protection, for it sometimes dies back in severe winters.

Propagation was formerly by layering but plants now are readily produced by cuttings. It has been suggested that the plant is nearly sterile to its own pollen and that seeds from self-pollinated plants do not germinate. More information is needed on this matter, however, for at least some seedlings have been raised in modern times.

Although known for many years first as *Gordonia pubescens* and later as *Gordonia "altamaha," Franklinia* is abundantly distinct from all members of *Gordonia* in fruit-shape and unique dehiscence, wingless seeds, and membranous and deciduous leaves. It is a remarkable plant which survives today only in cultivation, a fate not shared by many other rare and interesting native plants which may yet be facing total extinction.

4. **Stewartia** Linnaeus, 1754. (Named for John Stuart, 1713–1792, third Earl of Bute, who was distinguished in his day as a botanist.)

A genus of about six or seven species of eastern Asia and the southeastern United States. These are all handsome and showy deciduous shrubs or small trees worthy of far greater popularity. Their conspicuous white flowers coming as they do in midsummer are especially welcome and the attractive bark of several species is an additional interesting feature. Several species (notably *S. ovata* and *S. koreana*) have good autumn color.

Two species are native in the southeastern United States: *S. malacodendron* is primarily on the Coastal Plain and in the Piedmont from Virginia to Louisiana, and with an outlying station in Arkansas; *S. ovata* (*S. pentagyna*) is primarily a plant of the southern Appalachians in Kentucky, Tennessee, North Carolina, Georgia and Alabama. This latter species is by far the hardier of the two and is a very handsome tall shrub. *Stewartia malacodendron* has stamens with purple filaments, while *S. ovata* includes plants with white filaments or with deep purple

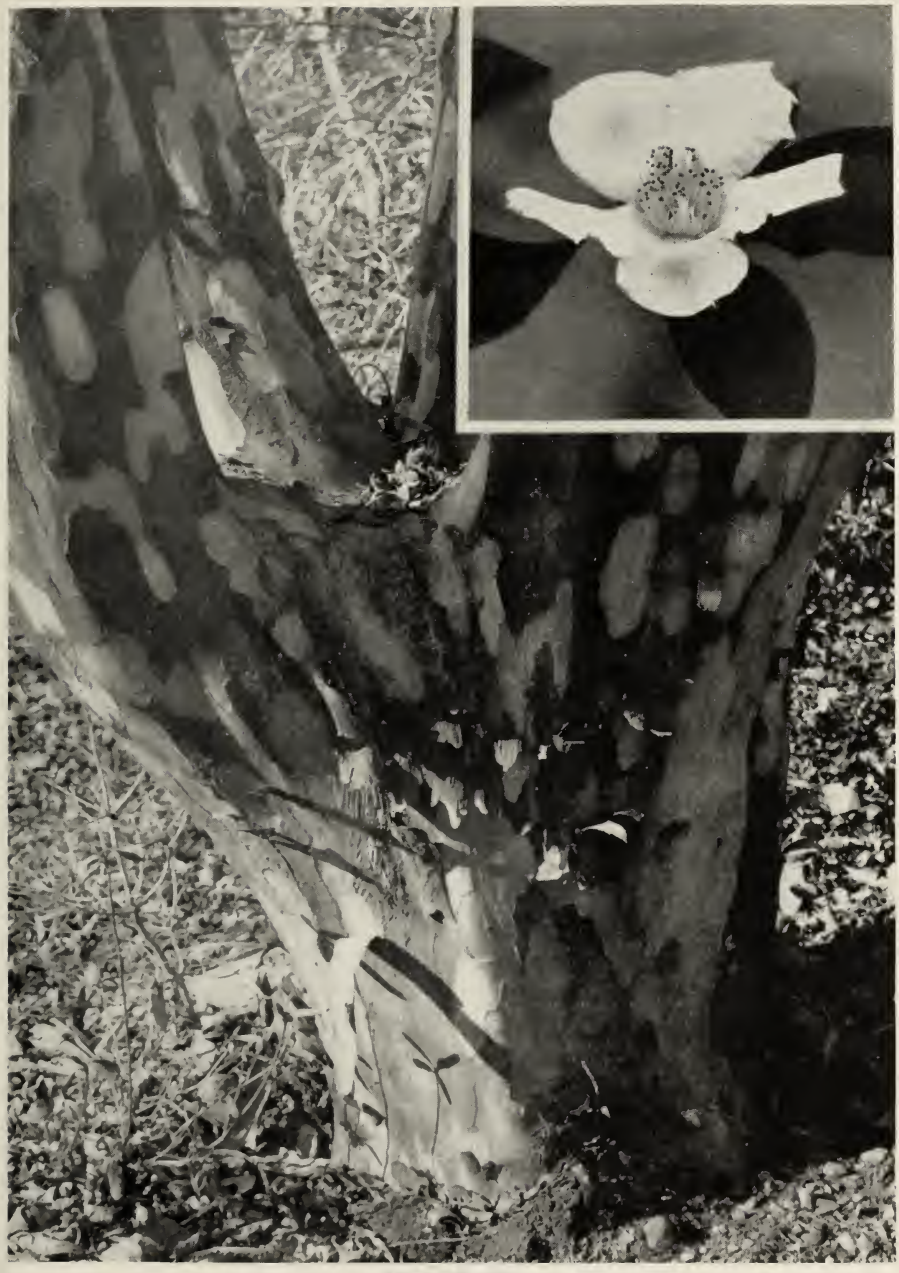

PLATE III

Both flowers and bark of *Stewartia pseudo-camellia* are ornamental. This tree, in the Arnold Arboretum, dates from 1891. The trunk is now 37 inches in circumference at the narrowest part visible here.

filaments. Some strains of this latter purple-filamented form, var. *grandiflora*, have from six to eight petals and are especially handsome.

Of the eastern Asiatic species, those in cultivation include at least *S. pseudocamellia*, *S. koreana* (a plant doubtfully distinct from the preceding species, and given varietal status by Bean), *S. serrata*, *S. monadelpha* and *S. sinensis*. All of these have white flowers with white stamen-filaments.

Stewartia ovata has sometimes been separated as the genus *Malachodendron* on the basis of its five distinct styles (in the others united into a single style), but it is obviously so closely related to the other species that all should be included in a single genus.

Stewartias are propagated either by seeds or softwood cuttings. Seedlings in rigorous climates (as Boston) need to be carried through at least the first several winters in the cold pit.

5. **Ternstroemia** Linnaeus filius, 1781. (Named for Christopher Ternstroem (1703–1746), a Swedish naturalist and student of Linnaeus, who died in the East Indies where he had gone to botanize, especially charged by Linnaeus (senior) with bringing back, among other things, a tea plant in a pot, or at least some seeds of it, and some live goldfish for the Queen of Sweden.)

A large genus in the tropics of both hemispheres, with numerous species in both areas. In the warmer areas of the United States at least two, *T. sylvatica*, of Mexico (States of Veracruz, Mexico, Guerrero, and Hidalgo), and *T. gymnanthera*, a native of Japan and China, are cultivated. *Ternstroemia gymnanthera* does well at least as far north as North Carolina; *T. sylvatica* is in cultivation in southern California. Both are exotic in appearance with stiffish evergreen leaves clustered near the tips of the branches. The flowers, which are rather inconspicuous, are followed by red, berry-like fruits about $\frac{1}{2}$ inch long. *Ternstroemia gymnanthera* is often found passing as *Cleyera japonica*, while the plant which should bear that name is often called *Eurya ochnacea*, a synonym.

6. **Cleyera** Thunberg, 1783. (Named for Andrew Cleyer, a physician and botanist, and Dutch Director of Commerce from 1683–1688.)

Sixteen species in the West Indies and Central America and, in the Old World, a single widespread, polymorphic species, *C. japonica*, which ranges from Japan and Korea to southern and western China and India. *Cleyera japonica*, a shrub or small tree (up to 40 feet in its native haunts) with elliptic to elliptic-obovate or obovate leaves, usually cuneate at the base and with entire margins, is cultivated in the warmer parts of the United States and at least as far north as central North Carolina in the East, and Oregon in the West. In contrast to the species of *Ternstroemia*, the leaves are not clustered at the tips of the branches, but are definitely alternate, giving the plant quite a different appearance. The small, white flowers are fragrant; the mature fruit is black. A handsome variegated

PLATE IV

This plant of *Stewartia orata*, collected near Highlands, N.C., in 1925, and cultivated at the Arnold Arboretum, shows the genetic instability of some *Camellia* cultivars. The stamen-filaments of flowers on different branches vary from white to light purple and occasional half-and-half flowers are found.

form, *tricolor*, has leaves "bright green, variegated with golden yellow and scarlet near the margins," and should be a handsome foliage plant. *Cleyera japonica* is known as "Sakaki" in Japan, where it grows wild in mountainous districts and where it is planted around homes and Shinto shrines. The plant has sacred connotations there and, according to Siebold and Zuccarini, was thought by the Buddhist priests to be closely related to the "Sara tree" under which Buddha died. There has been considerable confusion in the application of the name *Cleyera*, although it clearly applies to the plant to which it is here attached. *Ternstroemia gymnanthera*, a very different plant, is most frequently found masquerading as *Cleyera*.

7. **Eurya** Thunberg, 1783. (Name of uncertain derivation.)

A genus of about 55 species of evergreen shrubs and trees widely distributed in the eastern hemisphere. Apparently three species are sometimes cultivated in the warmer parts of the United States. The most common of these is *Eurya japonica*, native to Japan, the adjacent northern Liu-Kiu Islands, Korea and Quelpaert Island. This plant with 2-ranked foliage and coriaceous leaves with undulate-serrate margins is completely glabrous, even to the terminal bud, in contrast to *E. marginata* and *E. chinensis*, both of which are more or less hairy on the younger branchlets, at least. *Eurya chinensis*, of China and Formosa, has obovate leaves which are bluntly acuminate at the apex and cuneate at the base while *E. emarginata*, native to Japan, Korea, the Liu-Kiu Islands, and China, is similar but with heavier, leathery leaves which are always rounded-emarginate at the apex, rather than bluntly acuminate, and usually with revolute margins.

The group is horticulturally interesting only for the evergreen leaves 1–2½ inches long. The flowers are only about ¼ inch long and are inconspicuous in the axils of the leaves. The plants are unisexual, as in the hollies. The fruits are dark blue or black and are inconspicuous. The flowers of *E. japonica* are reported as having an unpleasant odor.

In horticultural literature references to "*Eurya latifolia variegata*" apply to *Cleyera japonica* forma *tricolor*, a handsome foliage plant.

Carroll E. Wood, Jr.

ARNOLDIA

A continuation of the
BULLETIN OF POPULAR INFORMATION
of the Arnold Arboretum, Harvard University

VOLUME 17 APRIL 5, 1957 NUMBER 3

WINTER INJURY—1957

LAST winter was not seriously injurious to the woody plants in the Arnold Arboretum. A cursory examination of the many trees and shrubs growing here on March 28 seems to show that few plants have been injured. Certainly, there is little browning of evergreen foliage, and winter ice storms have not been so serious as to cause much breaking of branches.

However, there was one day (January 15) during which the minimum temperature in the Arnold Arboretum went to at least -12° F. (this was at the greenhouse which is not the coldest spot in the Arboretum by any means) and stayed there nearly the entire day. The day before was also cold, being about -10° F. On only ten other days between the first of December and the end of February did the minimum temperature go below 10° F., and then it did not go below 3° F. All in all, any damage to flower buds probably can be traced directly to the one low cold spell of January 15. It is not very often that one can pin point the cause of winter injury so specifically. Regardless of what this cold spell has done in other parts of New England (temperatures of -22° F. were recorded at the Case Estates in Weston), we know now that there are some plants in the Arnold Arboretum the flower buds of which have been killed. There was at least a foot of snow on the ground at the time, so that lower branches of forsythias, apricots, etc., and many ground covers were not injured by the cold.

Gardeners in the New England area may be interested in checking some of the plants in the accompanying lists to note whether or not injury has been done in their own gardens. It will be of interest to compare notes with us concerning the early flowering shrubs, the flower buds of which are apparently uninjured. If any *Arnoldia* readers find, as their plants come into bloom this month, that there is injury other than reported here, traceable to the low cold, we would appreciate it if they would write to us about it, at the same time noting the minimum low temperature recorded for January 15 in their area. (Without this temperature

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notation, the record would not be useful.) Plants in these two lists normally bloom in the Arnold Arboretum during April (with a few noted exceptions), and, from the earliness of *Daphne mezereum*, which has been in full bloom for nearly two weeks, it looks as if this might be an early spring – at least it is proving so at present.

Flower Buds Killed or Partly Killed

(Unless otherwise mentioned, the flower buds apparently are mostly killed.)

Corylopsis spicata—75% of flower buds killed
Corylopsis veitchiana—85% of flower buds killed
Euonymus sanguinea—all foliage buds killed
Forsythia intermedia spectabilis—varying injury, some all flower buds killed, some in protected places, with only 25% killed
Lonicera fragrantissima
Lonicera purpusi
Lonicera standishi
Lonicera standishi lancifolia
Magnolia soulangeana—a few flower buds on some varieties, especially *M. soulangeana verbanica*, are killed
Pieris japonica
Prunus domestica flore plena
Prunus domestica plantieri—50% of flower buds killed
Prunus fenzliana
Prunus persica (normally blooms in May)
Prunus subhirtella autumnalis
Rhododendrons (do not bloom in April, but there was injury to some of the flower buds of the following):

- Rho. laetvirens
- Rho. minus
- Rho. smirnowi
- Rho. watereri
- Rho. "Cunningham's White"
- Rho. "Mrs. C. S. Sargent"
- Rho. "Norma"
- Rho. "Sultana"
- Rho. "Viola"

Damage only slight:

- Rho. "Delicatissimum"
- Rho. "Echse"
- Rho. "Flushing"
- Rho. "Purpureum Grandiflorum"

Viburnum fragrans—75% of flower buds killed

Flower Buds Apparently Not Injured

Abeliophyllum distichum
Acer rubrum
Chaenomeles lagenaria (blooms in May)

PLATE V

These magnolias will have flowers this month in the Arnold Arboretum. (*Upper*) Left to right: *Magnolia kobus*, *M. stellata*, *M. loebneri* "Merrill." (*Lower*) Left to right: *Magnolia salicifolia*, *M. denudata*, *M. proctoriana*.

Cornus officinalis
Cornus mas
Corylopsis pauciflora
Daphne mezereum
Daphne mezereum alba
Dirca palustris
Erica carnea (but covered by snow during cold spell)
Euonymus macroptera
Euonymus sachalinensis
Forsythia ovata
Hamamelis intermedia
Hamamelis japonica
Hamamelis mollis
Hamamelis vernalis
Lindera benzoin
Lonicera praeflorens
Magnolia denudata
Magnolia kobus
Magnolia proctoriana
Magnolia salicifolia
Magnolia stellata
Magnolia "Merrill"
Mahonia aquifolium (blooms in May)
Malus baccata mandshurica
Pieris floribunda
Prinsepia sinensis
Prunus apetala
Prunus cerasifera vars.
Prunus cyclamina
Prunus gracilis
Prunus hillieri
Prunus incisa
Prunus juddi
Prunus mandshurica
Prunus sargenti
Prunus subhirtella
Prunus tomentosa
Prunus triloba
Prunus yedoensis
Prunus "Hally Jolivette" (blooms in May)
Rhododendron carolinianum (blooms in May)
Rhododendron maximum (blooms in June)
Rhododendron mucronulatum
Spiraea prunifolia
Spiraea thunbergi (blooms in May)
Ulmus americana
Viburnum rhytidophyllum (blooms in May)

Donald Wyman

FINAL NOTICE OF TWO ARBORETUM SPRING CLASSES

There is still time to register for two classes at the Arnold Arboretum this spring. Application for registration should be addressed to Miss Martha Burow, Arnold Arboretum, Jamaica Plain 30, Massachusetts.

Symposia on Cultivated Plants: Thursday evenings, 7–9
April 25–May 23 Fee $10.00

The Arboretum staff members will be present to lead a series of discussions on the identification, culture, use, propagation, and care of magnolias, forsythias, flowering cherries and crab apples, lilacs, and azaleas.

Spring Field Class in Ornamental Plants: Friday mornings, 10–12
April 26–May 31 Fee $2.00

Informal walks through the Arboretum collections with discussions about the plants as they come into bloom. This is a continuation of the class which has been so popular at the Arboretum for many years.

ARNOLDIA

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of the Arnold Arboretum, Harvard University

VOLUME 17 APRIL 12, 1957 NUMBERS 4–5

THE HEDGE DEMONSTRATION PLOT
Twenty Years after Planting

THE hedge demonstration plot at the Arnold Arboretum was planted in 1936, and since that time has been a continuous source of practical information to thousands of visitors. Some of the hedges are in excellent condition, and have been so since the time they were planted. Others have done well for a few years while they were young, and then showed signs of poor growth with few branches at the base, thus giving rise to poor and unsightly hedges. Since 82 of the original 115 hedges are still alive and growing, it would seem that this might be an opportune time to take stock of this collection and note exactly what has occurred here during the past twenty years. All told, there have been 133 different kinds of plants grown as hedges in this plot.

Space has been the limiting factor from the beginning. Consequently, it has not been possible to grow all the kinds of plants that might be grown as hedges, but most of the more common types have been grown and enough of the little-used types to make the following lists of interest.

Most of the deciduous plants were about three feet tall when they were obtained for planting, although the evergreens and tree types were slightly taller. The deciduous plants were cut to within six inches of the ground immediately after planting — a standard practice if one desires dense, bushy plants well branched from the base. Commercial nurseries today offer plants specifically for hedge-making, plants which have been carefully pruned in the nursery row so that they are dense and ideally suited for hedge-making without such initial drastic pruning.

No special care was given in watering them after they had once become established. Pruning was carefully supervised and all have been sheared in about the same general form, wider at the base than at the top. The policy has been to prune them all thoroughly once a year, usually at the end of the growing season

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in late June or early July. Some of the more vigorous sorts have been given a second quick pruning in the early fall, just a removal of over-vigorous shoots or a shearing of some small growth to make the whole more symmetrical.

Various types of shears have been used including electrical shearing devices, but the various men who have done the job usually have come back to the old-fashioned hedge shears, claiming that these are easiest to handle in the long run.

The object has been to keep all the hedges well restrained so that a man standing on the ground would have no trouble in reaching the top with his shears. If a deciduous hedge became too vigorous or overgrown to be sheared this way, it was cut back severely or cut to the ground and started over again. Evergreen hedges were not so treated, since they do not respond to such rigorous treatment.

Fertilizing was seldom practiced — it only makes the hedge grow faster and creates more pruning work. Special spraying for insect and disease control was not necessary except in one or two instances. Trimmed grass walks were maintained about all the hedges, and occasionally hand weeding was necessary to keep some of the unsightly weeds properly restrained. Otherwise, this plot received no special care.

In the following lists, it will be noted that the hedges have been rated from "poor" to "excellent." An "excellent" hedge is one that is dense and well sheathed with branches to the base of the ground, showing a uniform growth of branches and foliage throughout. Such hedges would be *Euonymus alata compacta* and many of the evergreens. If properly sheared, these should keep this good habit year after year. Deciduous hedges, on the other hand, tend to grow faster than the evergreens and so may require more severe shearing one year than another. Because of this, they may appear a little "thin" the year of the heavier pruning, but eventually they will grow into good form.

There are, however, a number of vigorously-growing upright shrubs like *Lonicera tatarica* and *Physocarpus opulifolius*, which tend to produce few branches at the base. These are often open at the base because of this type of growth, and there is little that can be done about it, although they may be dense and well branched at the top. If a hedge is desired to keep out small animals, such plants should not be used unless a low piece of meshed wire is erected along the base of the plants at planting time. A large proportion of those hedges rated as "fair" are in this category.

Some have been rated as "poor" and the reasons given, while others have been so poor that they have had to be removed. The following table shows the heights and widths of hedges in 1945 and now. It is interesting to note that *Berberis thunbergi*, for instance, has been maintained at exactly the same general height and width for twelve years. This means, of course, that one year it may have been allowed to grow a few inches more than another, then later it was cut back more severely; but all in all, over a period of years, its general height remains the same. Proper shearing, therefore, can result in maintaining these hedges for a period of years at a desired height.

PLATE VI

(*Upper*) Part of the hedge demonstration plot in summer.
(*Lower*) Part of the hedge demonstration plot in winter.

GROWTH RECORD OF HEDGES NOW ALIVE IN THE ARNOLD ARBORETUM DEMONSTRATION PLOT

Deciduous

Scientific name	Year planted	Height of plants prior to planting	Height of clipped hedge		Width of clipped hedge		Common name
			Jan. 1, 1945	Jan. 1, 1957	Jan. 1, 1945	Jan. 1, 1957	
Acer campestre	1936	2–4*	4*	4*	4½*	3*	Hedge Maple
Acer ginnala	1936	5–6	5	6	5	4	Amur Maple
Acer platanoides	1936	—	—	5½	—	4	Norway Maple
Berberis gilgiana	1947	3	—	2	—	1½	Wildfire Barberry
Berberis koreana	1950	2½	—	3	—	2	Korean Barberry
Berberis mentorensis	1936	2	4	5	3½	4	Mentor Barberry
Berberis thunbergi	1936	1¼	3	3	3	3	Japanese Barberry
Berberis thunbergi argenteo-marginata	1950	2½	—	1½	—	1½	White-edged Japanese Barberry
Berberis thunbergi atropurpurea	1936	1½	3	3½	3	3	Red-leaved Japanese Barberry
Berberis thunbergi erecta	1936	1–1¼	2½	3	1½	2	Truehedge Columnberry
Berberis thunbergi minor	1936	1–1¼	2	1½	1½	1½	Box Barberry
Berberis thunbergi "Thornless"	1952	3	—	3	—	3	Thornless Japanese Barberry
Berberis "Sheridan Red"	1946	4	—	4	—	3	Sheridan Red Barberry
Betula populifolia	1936	—	—	4	—	3	Gray Birch
Caragana arborescens	1936	—	—	3	—	3	Siberian Pea-tree
Caragana frutex	1939	3	—	3	—	1½	Russian Pea-tree
Carpinus betulus	1936	1½–2	5¼	5½	6	5	European Hornbeam
Cercidiphyllum japonicum	1936	—	—	5	—	4	Katsura-tree
Chaenomeles lagenaria	1936	—	—	2	—	4	Flowering Quince
Cornus mas	1936	2–3	2½	5	2½	4	Cornelian-cherry
Cornus racemosa	1936	—	—	3	—	2	Gray Dogwood

* Measurements = feet unless otherwise designated.

Crataegus crus-galli	1936	2–3	3	6	$2\frac{3}{4}$	4	Cockspur Thorn
Crataegus monogyna	1936	2–3	$3\frac{1}{4}$	6	3	5	English Hawthorn
Crataegus pruinosa	1936	2–3	4	7	3	5	Frosted Hawthorn
Elaeagnus angustifolia	1936	$1\frac{1}{2}$–2	$3\frac{1}{2}$	3	$3\frac{3}{4}$	2	Russian-olive
Elaeagnus umbellata	1936	3	$4\frac{3}{4}$	5	$4\frac{1}{4}$	3	Autumn Elaeagnus
Euonymus alata compacta	1936	2–3	$3\frac{1}{2}$	$5\frac{1}{2}$	$3\frac{3}{4}$	5	Dwarf Winged Euonymus
Fagus grandifolia	1936	3–4	$2\frac{3}{4}$	6	3	6	American Beech
Fagus sylvatica	1936	$\frac{1}{2}$–1	$2\frac{1}{2}$	5	$2\frac{3}{4}$	6	European Beech
Forsythia intermedia	1936	$1\frac{1}{2}$–2	$3\frac{3}{4}$	$5\frac{1}{2}$	$3\frac{1}{4}$	5	Border Forsythia
Gleditsia triacanthos	1936	—	—	5	—	3	Common Honeylocust
Hypericum cistifolium	1950	2	—	2	—	2	California St. Johnswort
Kolkwitzia amabilis	1950	3	—	3	—	3	Beauty Bush
Ligustrum amurense	1936	6–12″	3	$5\frac{1}{2}$	$2\frac{1}{2}$	5	Amur Privet
Ligustrum ibolium	1936	$1\frac{1}{2}$–2	$2\frac{3}{4}$	6	$2\frac{3}{4}$	4	Ibolium Privet
Ligustrum ibota	1947	3	—	$2\frac{1}{2}$	—	2	Ibota Privet
Ligustrum obtusifolium regelianum	1936	2	3	4	$2\frac{1}{2}$	4	Regel Privet
Ligustrum ovalifolium	1936	$1\frac{1}{2}$	$2\frac{3}{4}$	7	2	5	California Privet
Ligustrum sinense	1950	3	—	$2\frac{1}{2}$	—	2	Chinese Privet
Ligustrum vicaryi	1950	3	—	$2\frac{1}{2}$	—	2	Vicary Golden Privet
Ligustrum vulgare	1936	2–3	$2\frac{3}{4}$	6	$2\frac{1}{2}$	5	European Privet
Ligustrum vulgare "Lodense"	1947	3	—	2	—	$1\frac{1}{2}$	Low Dense Privet
Lonicera fragrantissima	1936	2–3	$4\frac{1}{4}$	6	$4\frac{1}{2}$	6	Winter Honeysuckle
Lonicera tatarica	1936	—	—	3	—	$2\frac{1}{2}$	Tatarian Honeysuckle
Maclura pomifera	1936	—	—	4	—	3	Osage-orange
Philadelphus coronarius	1936	2–3	$4\frac{3}{4}$	4	4	3	Sweet Mockorange
Philadelphus lemoinei erectus	1950	2	—	2	—	$1\frac{1}{2}$	Upright Lemoine Mockorange
Physocarpus intermedius parvifolius	1947	$3\frac{1}{2}$	—	3	—	2	Dwarf Illinois Ninebark
Physocarpus opulifolius	1936	2–3	$5\frac{1}{4}$	$4\frac{1}{2}$	$4\frac{3}{4}$	4	Ninebark
Platanus acerifolia	1936	2–3	6	7	5	6	London Plane Tree

Scientific name	Year planted	Height of plants prior to planting	Height of clipped hedge		Width of clipped hedge		Common name
			Jan. 1, 1945	Jan. 1, 1957	Jan. 1, 1945	Jan. 1, 1957	
Populus alba pyramidalis	1936	—	—	6	—	3	Bolleana Poplar
Potentilla fruticosa purdomi	1954	2	—	1½	—	1½	Purdom Bush Cinquefoil
Prinsepia sinensis	1936	—	—	4	—	3½	Cherry Prinsepia
Quercus imbricaria	1938	2	4	7	3¾	7	Shingle Oak
Quercus palustris	1936	6–8	5¾	5½	5½	4	Pin Oak
Quercus robur fastigiata	1936	—	—	8	—	4	Pyramidal English Oak
Rhamnus cathartica	1936	2–3	3½	5½	3	4	Common Buckthorn
Rhamnus frangula	1936	2–3	3½	5½	3	4	Glossy Buckthorn
Ribes alpinum	1939	10″	2	4	2	4	Mountain Currant
Rosa virginiana	1936	—	—	3	—	3	Virginia Rose
Salix pentandra	1936	—	—	3½	—	3	Laurel Willow
Spiraea nipponica	1936	—	—	3	—	3	Nippon Spirea
Spiraea prunifolia	1936	2–3	3	4	2½	3	Bridalwreath Spiraea
Spiraea thunbergi	1936	2–3	2¼	2	2½	2	Thunberg Spirea
Spiraea vanhouttei	1936	—	—	5	—	5	Vanhoutte Spirea
Spiraea veitchi	1950	4	—	2½	—	1½	Veitch Spirea
Syringa chinensis	1936	—	—	5	—	4	Chinese Lilac
Syringa josikaea	1936	—	—	4	—	3	Hungarian Lilac
Syringa laciniata	1947	3	—	2	—	2	Cutleaf Lilac
Syringa vulgaris	1936	2–3	3	6	3	5	Common Lilac
Tilia cordata	1936	9–12″	6	6	6	5	Littleleaf European Linden
Ulmus parvifolia	1950	4	—	3	—	2	Chinese Elm
Viburnum dentatum	1936	2–3	3¼	5	2¾	3	Arrowwood
Viburnum prunifolium	1936	2–3	3¼	5	3	3	Blackhaw
Viburnum sargenti	1950	3	—	3	—	3	Sargent Viburnum

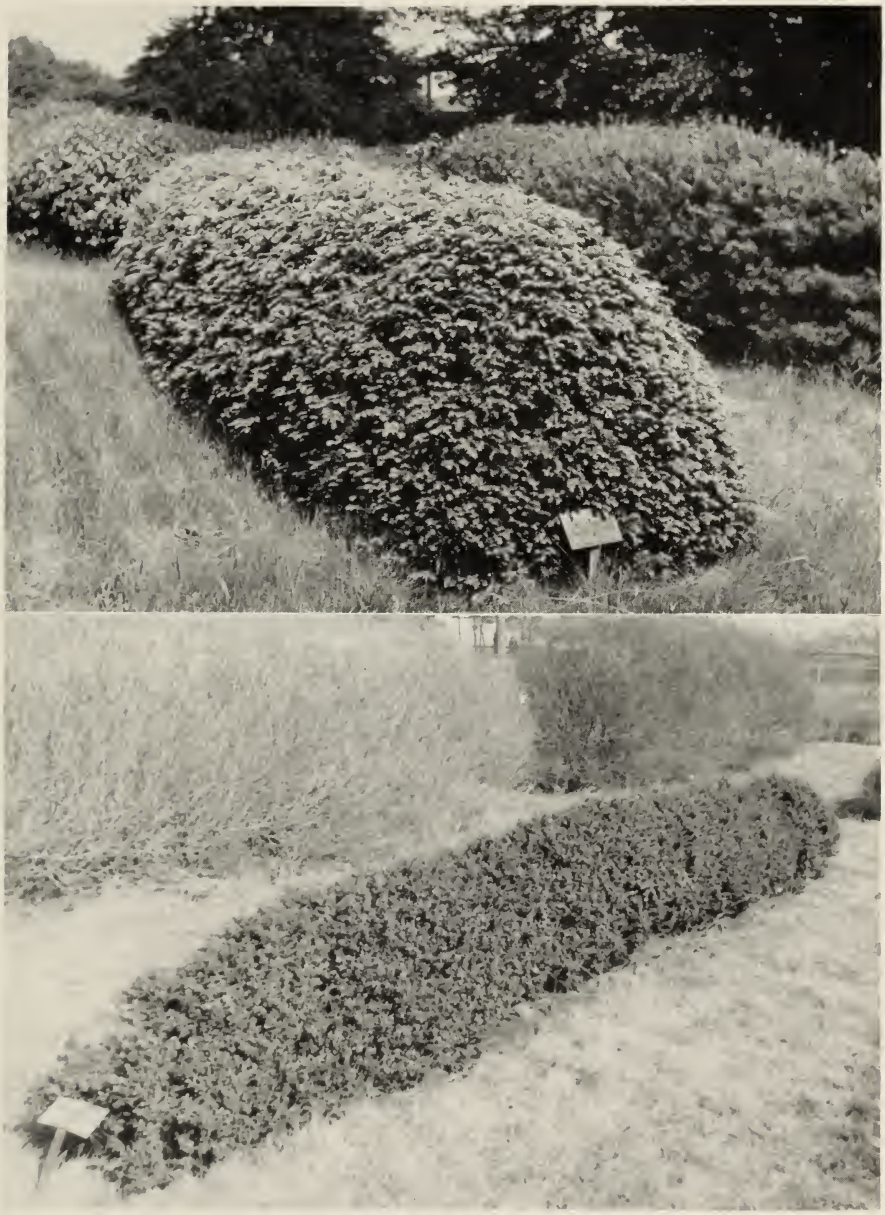

PLATE VII

(*Upper*) Canada hemlock hedge eighteen years old, 4½ feet high and 4 feet wide; one of the best evergreen hedges.

(*Lower*) Convex-leaved Japanese holly hedge (*Ilex crenata convexa*) eighteen years old, 2½ feet high, 2 feet wide; another of the excellent evergreen hedges.

GROWTH RECORD OF HEDGES NOW ALIVE IN THE ARNOLD ARBORETUM DEMONSTRATION PLOT

Evergreen

Scientific name	Year planted	Height of plants prior to planting	Height of clipped hedge		Width of clipped hedge		Common name
			Jan. 1, 1945	Jan. 1, 1957	Jan. 1, 1945	Jan. 1, 1957	
Abies concolor	1936	1–1 1/4*	4*	4*	3 1/2*	4*	White fir
Buxus microphylla koreana	1936	6–9″	1 1/2	2	1 1/4	2 1/2	Korean Box
Buxus microphylla koreana hybrid	1936	6–9″	1 1/2	2	1 1/4	3	
Chamaecyparis pisifera filifera	1936	3	5 1/2	7	4 1/2	7	Thread Retinospora
Chamaecyparis pisifera plumosa	1936	1–1 1/2	2 3/4	3 1/2	3 1/4	5	Plume Retinospora
Ilex crenata convexa	1939	1 1/2	—	2 1/2	—	2	Convex Japanese Holly
Ilex opaca "Clark"	1942	2	—	3 1/2	—	3	Clark American Holly
Juniperus virginiana	1936	2–3	3 1/2	4 1/2	2 3/4	3 1/2	Red-cedar
Picea abies	1936	3	4	5	4 1/4	6	Norway Spruce
Picea omorika	1936	1–1 1/4	2 1/2	3	3 1/4	3 1/2	Serbian Spruce
Picea orientalis	1936	3–6″	2 3/4	2 1/2	2′2″	3	Oriental Spruce
Picea pungens glauca	1936	2–3	3 1/2	3 1/2	3 1/4	4	Blue Colorado Spruce
Pinus mugo mughus	1936	—	—	3	—	5	Mugho Pine
Pinus strobus	1936	1 1/4	3 1/2	5 1/2	3	5	White Pine
Pinus sylvestris	1936	—	—	6	—	6	Scotch Pine
Pseudotsuga taxifolia	1936	1 1/4	2 3/4	4	2 1/2	3	Douglas-fir
Taxus cuspidata	1936	1 1/4–1 1/2	2 1/4	3	2 1/2	4	Japanese Yew
Taxus cuspidata "capitata"	1936	1 1/4–1 1/2	2 1/2	3 1/2	2 1/2	3 1/2	
Taxus cuspidata nana	1936	1–1 1/4	1 1/2	1 1/2	2 1/4	3	Dwarf Japanese Yew

*Measurements = feet unless otherwise indicated.

Taxus media (hedge form)	1936	1½–2	2	2½	2	4	
Taxus media hatfieldi	1936	1½–2	2	2½	2	4	Hatfield Yew
Taxus media hicksi	1936	2–3	2	2½	2½	4	Hicks Yew
Thuja occidentalis	1936	2	3	4	2¼	3	American Arborvitae
Thuja occidentalis globosa	1936	1½	2½	2½	2¼	3	American Globe Arborvitae
Thuja occidentalis "Little Gem"	1938	6–9″	1½	2½	2½	2	Little Gem Arborvitae
Thuja occidentalis robusta	1936	2–2½	3	3½	2½	3	Ware's Arborvitae
Thuja occidentalis spiralis	1936	—	—	5	—	3	Spiral Arborvitae
Thuja occidentalis wagneriana	1936	—	—	3	—	3	Wagner Arborvitae
Thuja occidentalis woodwardi	1936	1–1¼	2	2½	1¾	3	Woodward Arborvitae
Thuja plicata	1936	9–12″	3¼	3	2	2½	Giant Arborvitae
Tsuga canadensis	1939	1½	3¼	4½	2¾	4	Canada Hemlock
Tsuga canadensis compacta	1947	1½	—	2½	—	2	Compact Canada Hemlock
Tsuga caroliniana	1936	1½	3	4	2¾	4	Carolina Hemlock

PLANTS WHICH HAVE MADE GOOD TO EXCELLENT HEDGES

Deciduous

Acer campestre
Berberis mentorensis
— thunbergi
— — minor
Carpinus betulus
Cornus mas
Crataegus crus-galli
— monogyna
Elaeagnus umbellata
Euonymus alata compacta
Fagus grandifolia
— sylvatica
Forsythia intermedia
Kolkwitzia amabilis
Ligustrum amurense
— ibolium
— obtusifolium regelianum
— ovalifolium
— vicaryi
Ligustrum vulgare
— — "Lodense"
Lonicera fragrantissima
Philadelphus coronarius
Prinsepia sinense
Quercus imbricaria
Rhamnus cathartica
— frangula
Ribes alpinum
Salix pentandra
Spiraea prunifolia
— vanhouttei
Syringa chinensis
— laciniata
— vulgaris
Tilia cordata
Viburnum dentatum
— prunifolium

Evergreen

Buxus microphylla koreana
Chamaecyparis pisifera filifera
— — plumosa
Ilex crenata convexa
— opaca "Clark"
Juniperus virginiana
Picea abies
— omorika
— orientalis
— pungens glauca
Pinus mugho mughus
— strobus
— sylvestris
Pseudotsuga taxifolia
Taxus cuspidata
— — "capitata"
— — nana
— media hatfieldi
— — hicksi
Thuja occidentalis
— — "Little Gem"
— — robusta
— — spiralis
— plicata
Tsuga canadensis
— — compacta
— caroliniana

PLANTS WHICH HAVE MADE ONLY FAIR HEDGES

Acer ginnala	Not sufficiently dense
Berberis gilgiana	Too vigorously upright; few branches at base
— koreana	Too vigorously upright; few branches at base
— thunbergi argenteo-marginata	Not sufficiently vigorous in growth
— — erecta	Too vigorously upright; few branches at base
— — "Thornless"	Our hedge not as good as the species
Cornus racemosa	Single branches all from ground; needs a wide strip in which to become dense enough for a suitable low hedge
Crataegus pruinosa	Too coarse for low hedge
Elaeagnus angustifolia	Not sufficiently dense
Ligustrum sinense	Not as dense as other privets
Lonicera tatarica	Too vigorously upright; few branches at base
Maclura pomifera	Not satisfactory for low hedge
Philadelphus lemoinei erectus	Too vigorously upright
Physocarpus intermedius parvifolius	Few branches at base
— opulifolius	Too vigorously upright; few branches at base
Platanus acerifolia	Foliage entirely too coarse for low hedge
Quercus palustris	Foliage entirely too coarse for low hedge
— robur fastigiata	Too vigorously upright; no branches at base
Spiraea nipponica	Too vigorously upright; few branches at base

PLANTS WHICH HAVE MADE POOR HEDGES

(Some of these have been removed; others are still growing in the Hedge Demonstration Plot at the Arnold Arboretum)

Abies concolor	Rated as only mediocre in 1945 and as poor now, these plants apparently cannot withstand annual shearing in this climate and look well.
Abies fraseri	Very open at the base; not vigorous enough in this area to be sheared periodically. Removed 1947.

Acanthopanax sieboldianus	Supposedly making a good hedge for city conditions, this hedge was excellent the first few years after planting, yet was decidedly mediocre in 1945 and practically died out by 1957.
Acer platanoides	Plants extremely open at base, branching coarse and open, leaves coarse, making an extremely poor clipped hedge in the lower sized groups.
Berberis vulgaris	This, like several other shrubs, grows so vigorously upright that the base of the plant is open and devoid of lateral branches, making it a poor plant for hedges.
Berberis "Sheridan Red"	See note under "Berberis vulgaris."
Betula populifolia	Listed as only mediocre in 1945 and as poor in 1957, this hedge is not dense but open, making this species undesirable for hedge purposes.
Caragana arborescens	This hedge has been a disappointment here, for it has been among the best (and hardiest) at the Ottawa Experimental Station in Canada since 1889. However, there it is growing in a heavy soil and here in the Arnold Arboretum, the soil is light and gravelly. As grown here, it was only mediocre in 1945 and is listed as decidedly poor now, open at the base.
Caragana frutex	Little lateral growth at the base of the plants. It has been noted that this plant has made a good hedge at Ottawa, Canada. Possibly this species also does better in heavy soils.
Carpinus caroliniana	Did not withstand annual shearing well after 1945 when it was rated as good. Apparently, as it grows older, it cannot be restrained properly.
Cercidiphyllum japonicum	Rated as poor in 1945, this is still decidedly poor in 1957. It grows so vigorously upright that plants are open at the base, thus making a poor hedge.
Chaenomeles lagenaria	Rated as poor in 1945 and still as poor in 1957, these plants have not made as good a hedge as many others.
Chamaecyparis pisifera squarrosa	Did not withstand annual shearing well after 1945, wnen it was subjected to much heavier shearing than previously. Removed.

Clethra alnifolia	Plants are very open and devoid of branches at the base. Removed. This hedge was growing in a very poor, dry soil which was probably the cause of its poor growth. Normally, this plant thrives in moist situations and then becomes much more dense in over-all habit.
Deutzia gracilis	Stems died back after each winter. Removed.
Ginkgo biloba fastigiata	Plants have too rapid an upright growth, leaving bases entirely devoid of lateral branches. Removed.
Gleditsia triacanthos	Much too open to compete with other plants as a small hedge. So rated in 1945 and again in 1957.
Hippophae rhamnoides	Poor growth in general, but might grow better in a more humid climate and in alkaline soil. Removed.
Hypericum densiflorum	Apparently killed out by competition of grass and weeds.
Juniperus communis	Did not withstand annual shearing well. Parts of plants died after shearing. Removed.
Ligustrum ibota	Base of plants open.
Lonicera korolkowi floribunda	Poor and weak growth in general. This hedge was replanted three different times and finally was removed as too difficult to establish.
Philadelphus coronarius pumilus	Does not grow symmetrically as a low plant. Removed.
Pinus mugo	Plants became quickly infested with scale and all died shortly. The scale has been completely controlled on the smaller growing *Pinus mugo mughus.*
Pinus nigra	Open at the base, not dense. Removed.
Populus alba pyramidalis	Too vigorous in terminal growth. These plants have no branches at the bases, hence they have little value in hedge-making.
Populus nigra italica	Plants make too rapid an upright growth with no lateral growth at base. Removed.
Potentilla fruticosa purdomi	Plants open at base, making a poor hedge.

Prunus japonica nakai	Plants made poor growth in general. Removed.
Prunus tomentosa	For the first ten years, this was one of the best hedges, but then the plants started to die and finally all had to be removed.
Rosa rugosa	This should make one of the best hedges, especially for seashore gardens. However, our plants were early infected with a stem borer which we could not control at that time, and as a result all plants were removed.
Rosa virginiana	Not sufficiently dense for a clipped hedge. Does not compare favorably with others for this purpose.
Salix purpurea	Plants are too open in general habit to form a good hedge. Removed.
Spiraea bumalda	Open at the base. May have been crowded out with competition from grass. Removed.
Spiraea thunbergi	Rated as a good hedge in 1945 (planted 1936), these plants since that time have been susceptible to some die-back and to poor growth.
Spiraea veitchi	Little lateral growth at the base of the plants, making an open hedge.
Symphoricarpos albus laevigatus	Plants did not respond well to annual shearing. Removed.
Syringa josikaea	For some unknown reason, this has proved to be a consistently poor grower in our plot. It should be a vigorously-growing shrub.
Tamarix pentandra	Plants were too open in general habit. Most of the plants winterkilled badly and all had to be removed.
Taxus canadensis stricta	These plants would have grown much better if planted in some shade rather than in the full sun. Removed.
Thuja occidentalis globosa Thuja occidentalis wagneriana Thuja occidentalis woodwardi	None of these hedges "grow old gracefully." As young plants, they may prove satisfactory for a few years, but they do not have a central trunk or leader and gradually grow with several weak leaders. In the winter during the past few years, snow and ice have lodged in the branches and

PLATE VIII

(*Upper*) *Prinsepia sinensis* hedge, very graceful when unclipped for a few years. This hedge is now formally sheared annually.

(*Lower*) The fastigiate English oak makes only a fair, tall hedge, for it grows so vigorously upright that there are wide openings at the ground level, devoid of branches.

	actually have broken them, making large, open spots devoid of foliage. Hence, these plants are not considered good for hedges of long life, and should be avoided.
Ulmus parvifolia	Plants open at base making a poor hedge.
Ulmus pumila	These plants were poor to begin with and never overcame this poor start. Eventually they were removed.
Viburnum lantana	Poor growth in general; rated as a poor hedge in 1945 (planted in 1936) and removed two years later.
Viburnum opulus nanum	Nine of ten plants died within three years. These were growing in poor soil, but this variety has been difficult to keep in a vigorous growing condition even in good soil in the viburnum collection at the Arboretum.
Viburnum sargenti	Plants open at base, foliage rather coarse, making a poor hedge.

Donald Wyman

ARNOLDIA

A continuation of the
BULLETIN OF POPULAR INFORMATION
of the Arnold Arboretum, Harvard University

VOLUME 17 | May 3, 1957 | NUMBER 6

SOMETHING NEW HAS BEEN ADDED
COCOA-SHELL MULCH

VISITORS in the Arnold Arboretum this spring will notice that there is a brown mulching material around many of the trees and shrubs on the grounds and along the long lines of shrubs in the shrub collection adjacent to the Forest Hills Gate. This material is the shells of the cocoa bean which is being used as a trial. It has several advantages but some disadvantages, as well. It is too soon for us to know its general effect on the plants so that recommendations for its use at this time would be premature.

In the first place, we were able to obtain it this winter at no expense but the hauling—rather an asset to the Arboretum! Secondly, it does not burn vigorously nor does it blow much in the wind. Any mulch on soils in this area is usually better than none, and it does aid materially in conserving soil moisture, a very important factor in drought periods. It comes dry from the factory, is easily applied and contains a considerable amount of nitrogen. The spent hops which we were using for so many years is now unavailable to us, the chief reason why so much of the cocoa-shell mulch has been applied this winter.

There are apparent disadvantages. When first applied and moist, especially in hot weather, it will heat to such an extent that if it is applied to depths of six inches at the base of young plants, the high temperature can kill the young stems. This is the reason why it is being kept in the Arboretum at a distance of a foot or so from the plant stems. As it begins to disintegrate, it becomes mouldy and extremely slippery, actually dangerous for one to walk on. Then, as it dries off on the surface during dry periods, it can cake on the top to such an extent that there may be danger of insufficient air filtering through to the roots of surface rooted plants like rhododendrons and azaleas. We have not used it extensively on the ericaceous plants. A high concentration of potash salts can be leached out of the

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mulch and may cause some plant injury. Also, if applied to a flower border, for instance, it certainly would not be the nicest material to dig in with the hands.

Test applications of this material have been used on experimental plants at the Case Estates in Weston, to ascertain at what depths it may be injurious to vigorous growing shrubs. Applied as it has been in the Arboretum, seldom over four inches deep and well away from the base of the plants, it is hoped that only good results will be obtained, but it must be emphasized that there may be injury to some plants from a high accumulation of potash salts. Visitors can check these results for themselves throughout the spring and summer merely by observing the reactions of the plants so treated.

YELLOW LABELS

Another addition to the plantings of the Arboretum this spring is a new, small yellow label marked "Introduced into the United States by the Arnold Arboretum." Nearly 1,800 of these have been placed on the shrubs and trees about the grounds and the job is not yet completed. This label signifies that the plant on which it appears was first brought into the United States by the Arboretum. Lest there be some who might be overly critical, it must be noted here that this label will appear on some plants native to North America; but, though somewhat ambiguous in this case, the label signifies that this native American plant was first brought into cultivation by the Arboretum. So, one now can begin to see at a glance the hundreds of plants the Arboretum takes credit for introducing.

BLOOMING DATES

The season has been a confusing one. Many shrubs bloomed earlier than normal, then there followed a cold spell in early April which placed blooming dates back on schedule. This, in turn, was followed by very warm, dry weather for several weeks, which is now forcing most plants into very early bloom again. Last year, the season was very retarded, with few lilacs in bloom until the end of May. This year, they will bloom a full week earlier than their usual time, which is about the third week of May. To give some idea of the earliness of spring in past years, the willow tree across the brook from the Administration Building turned green on the following dates:

1950—April 28
1951—April 8
1952—April 19
1953—April 5
1954—April 15
1955—April 14
1956—May 3
1957—April 21*

*This was followed by truly hot weather, thus further advancing blooming dates.

PLATE IX

There are, undoubtedly, too many billboards, but if they must be used, this one might be considered less controversial than most. It was displayed in full color for several months last year in Brookline, Mass., and depicts the Forest Hills Entrance of the Arnold Arboretum as it now appears.

Some of the blooming dates for May are estimated (at this time!) to be:

Week of May 5

Oriental Flowering Crab Apples
Oriental Quinces
Early Lilacs (*Syringa oblata* and varieties)
Royal Azalea
Korean Azalea
Redbud

Week of May 12

Common Lilac and its many varieties
Flowering Dogwood
Fothergilla species
Weigela—early varieties

Week of May 19

Chinese Lilac and varieties
Pinxterbloom (as well as *Rhododendron roseа*)
Rhododendron "Boule de Neige" and "Mont Blanc"
Hawthorns—many
Shrubby Honeysuckles—many
Primrose Rose
Viburnums—several

SUNDAY, MAY 12, IS OPEN HOUSE AT THE CASE ESTATES

For all those who would like to become more familiar with the plantings on the Case Estates of the Arnold Arboretum in Weston, this is an excellent opportunity. Staff members will be stationed about the grounds from 10 a.m. to 5 p.m., to give directions and to answer questions concerning the plants. The Case Estates are situated in the center of the Town of Weston adjacent to the public school buildings on Wellesley Street.

Of particular interest will be the Ground Cover Demonstration Plots, with well over 150 different plants; the Small Tree Demonstration Plots, with about 80 different small trees suitable for the small garden; the Small-Shrub and Perennial Garden; the new Pruning Demonstration Plots, Dwarf Apple Trial Plots, and the many hundreds of plants growing in the nurseries. The Case Estates are easily accessible on Wellesley Street, Weston, from Routes 9, 20, and 30.

SUNDAY, MAY 19, IS OPEN HOUSE IN THE ARNOLD ARBORETUM

Staff members will also be strategically located about the grounds of the Arnold Arboretum on Sunday, May 19, to give directions and to answer questions from 10 a.m. to 5 p.m. Originally, when this date was set, it was hoped the lilacs would be in full bloom, but unusually warm weather will force a majority of them into bloom a week sooner. However, there are always hundreds of plants in bloom at this time of year, so that a visit is a real experience for anyone interested in plants.

Parking will be permitted on this day only, inside the Arboretum from the Centre Street Gate (entrance from Route 1) to the South Street Gate. Parking is also possible immediately outside the grounds. The Arboretum is in Jamaica Plain at the junction of Centre Street (Route 1) and the Arborway (Routes 3, 28, and 138).

Donald Wyman

ARNOLDIA

A continuation of the
BULLETIN OF POPULAR INFORMATION
of the Arnold Arboretum, Harvard University

VOLUME 17 | June 21, 1957 | NUMBER 7

WINTER INJURY – 1957 (Continued)

THE final chapter can now be written concerning the extreme cold of last January and the amount of damage it did to the woody plants in the Arnold Arboretum. Listed already in an earlier issue of *Arnoldia* (Vol. 17, No. 3; April 5, 1957) are those plants the flower buds of which were killed. Then it was too early to determine the amount of actual killing of woody stems, but now, most plants have normally produced their leaves so that actual killing of woody stems can be noted definitely.

Brief mention might be made of the vagaries of the weather this spring: the warm start followed by very cold temperatures; followed again by warm weather and drought; and again followed by a cold, wet spell the week of May 12. Plants bloomed in spurts, but it was this last cold spell that held many of the lilac blossoms in bloom for almost two full weeks, so that it could be said they were in good condition and fully in flower on May 20, the average date they are expected to bloom normally. All in all, by June 1, the blooming season was about "on schedule."

Some of the shrubs and small trees, though not severely injured to a noticeable extent, were rather slow in producing leaves, which when they did appear were at first rather small and stunted. This did not seriously hurt such plants, although on many of them the flower buds also were killed, while those branches which were below the snow line produced normal flowers and leaves at the normal time.

The majority of plants which had stems and branches killed this year were not listed as hardy in Zone 4, some not even hardy in the warmer Zone 5. Consequently, one could have predicted in advance many of the plants which actually were injured as a result of this very low temperature of -12° F. or possibly lower. Those in the following lists all were injured to some extent in the past winter in the Arnold Arboretum:

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Plants Killed to the Ground During the Winter of 1956–57

(or which were so badly injured they had to be pruned to the ground to rejuvenate them properly)

Name	*Height* (feet)
Amorpha brachycarpa	4
Amorpha canescens	4
Baccharis halimifolia	5
Berberis buxifolia nana	1
Berberis julianae (Shrub Collection only)	6
Buddleia davidi vars.	5
Callicarpa sp.	7
Ceanothus pallidus roseus	2
Clerodendron trichotomum	6
Cotoneaster glabrata	5
Dipelta floribunda	6
Desmodium dilleni	–
Deutzia — all in Shrub Collection either to ground or to snow line, except *Deutzia lemoinei compacta*, 4′, and *Deutzia gracilis*, 2′, which were uninjured	4–8
Elsholtzia stauntoni	5
Grewia biloba	4
Helwingia japonica (plant in Shrub Collection, only)	6
Hydrangea quercifolia	3
Hydrangea serrata	3
Hypericum ascyron	4
Hypericum galioides	3
Hypericum patulum and vars.	3
Hypericum 'Hidcote'	3
Hypericum 'Sun Gold'	2

Indigofera amblyantha	5
Indigofera incarnata alba	2
Indigofera kirilowi	1–½
Ilex cornuta	6–7
Jamesia americana	1
Kolkwitzia (Shrub Collection, only)	7
Lespedeza, all species	5–6
Ligustrum ovalifolium	8
Ligustrum sinense	6
Lonicera quinquelocularis	7
Lonicera standishi lancifolia	5
Rhododendron mucronatum album	2
Sorbaria sp.	6
Stephanandra tanakae	6
Weigela coraeensis	3
Weigela hortensis	3
Weigela japonica sinica	4
Wisteria sinensis plena (nearly to ground)	–
Vitex incisa	4
Zanthoxylum schinifolium	12
Zanthoxylum simulans	7

Plants Partially Injured During the Winter of 1956–57

Name	*Height* (feet)	*Amount of injury*
Abelia engleriana	3	Slightly injured
Albizzia julibrissin rosea	15	Badly injured
Berberis beaniana	4	75% injured

Berberis julianae	5	75% injured (Center Street planting not injured much)
Cercis chinensis	6	10% injured
Cornus florida rubra	10	Flower buds and branches injured
Corylopsis veitchiana	8	Badly injured
Davidia involucrata	20	No flowers
Dipelta floribunda	10	50% injured
Hovenia dulcis	30	Killed to about 6′; 4-6″ in diameter branches and some smaller ones, too. Another plant only 20% killed.
Ilex cornuta	8–10	75% injured
Ilex decidua	6	Badly injured
Ilex montana	8	Killed nearly to ground
Itea virginica	5	50% injured
Kerria japonica aureo-vittata	4	25% injured
Kerria japonica picta	4	25% injured
Lindera praecox	15	50% injured
Lonicera floribunda	5	25% injured
Lonicera involucrata serotina	6	75% injured
Lonicera quinquelocularis translucens	12	75% injured
Lonicera standishi rosea	7	75% injured
Neillia sinensis	5	75% injured
Rhododendron discolor	6	All flower buds killed
Rhododendron obtusum kaempferi	6	Major part of flower buds killed
Rosa laevigata	5	75% injured
Rosa luciae	5	50% injured
Spiraea japonica vars.	4	50–75% injured

Stephanandra incisa	6	75% injured
Styrax americana	8	Slightly injured
Weigela florida	6	50% injured
Weigela florida 'nana variegata'	5	75% injured
Weigela vanicecki	6	25% injured
Weigela venusta	6	25% injured
Weigela 'Bristol Ruby'	6	25% injured
Weigela 'Conquerant'	6	75% injured
Weigela 'Esperance'	6	75% injured
Weigela 'Gratissima'	6	75% injured
Weigela 'Lavelli'	6	75% injured
Weigela 'Newport Red'	6	25% injured

A NEW BOXWOOD

The Arnold Arboretum has been interested in growing many clones of *Buxus sempervirens* which have supposedly proved hardy in the colder sections of the northern United States. Some of these have proved more hardy than others, but most of them are just not reliably hardy in the cold winters which can kill them back severely.

Although boxwood is grown in many a New England garden (even the more tender *Buxus sempervirens suffruticosa* can be found), these are grown only in gardens that are well protected from high winter winds and winter cold. In exposed situations, most of the *Buxus* clan suffers in New England.

When Dr. Edgar Anderson was on the staff of the Arnold Arboretum in 1935, he visited the northern Balkans in search of plants that might prove of interest to American gardeners. He was especially interested in a low, wide-spreading plant of *Buxus sempervirens*, not only because of its habit, but also because of its apparent hardiness, since it was growing in a section of Yugoslavia in the Vardar Valley with dry, hot summers, cold and sunny winters, and late spring cold waves. He collected cuttings and sent them to the Arboretum where they were rooted. Later they were planted out on the grounds and in the nurseries for a long trial period. It did not seem advisable to become enthusiastic about this plant until it had become thoroughly tried in America.

Eight plants were grown to size over a period of many years. Several of these were sent outside the Arboretum for trial elsewhere. Cuttings were sent to at least one commercial nursery which, in turn, rooted them and propagated more, selling the resulting plants. Enthusiastic responses have come from several of these sources so that now it is thought wise to name this plant *Buxus sempervirens* 'Vardar Valley' and to start propagating it for a wide distribution.

Buxus sempervirens 'Vardar Valley' is a clone of the species, collected in the native habitat of *Buxus sempervirens* in the Balkans. Cuttings, rooted in 1935, have grown into plants that are now four feet across, with a fairly uniform flat top, but only two feet high, This habit is of outstanding importance, for it is low enough to be covered or partially covered by snow in the winter, or else it is an easy matter to protect the plant in other ways when necessary. It is unlike other varieties of *Buxus sempervirens* in having this low, flat-topped shape. Apparently, it is as hardy as any clone we have yet tried. In January of 1957, the temperature dropped to -23° F. at Weston, and although there was some snow on the ground, the top of the plant was not covered nor was it injured. A large plant in the Arboretum has not shown any marked winter injury. Reports from others in Cleveland, show that it has withstood temperatures of -20° F. there, and we know that it has withstood similar temperatures in Boston. The foliage

PLATE X

Buxus sempervirens 'Vardar Valley,' twenty two years old, growing in the Arnold Arboretum where it is 2′ high and 4′ across.

is a glossy, dark green, similar to that of the species, while new young foliage is first bluish green.

The plant given this name is No. 352-35 now growing in the collections of the Arnold Arboretum and photographed in this issue of *Arnoldia*. Herbarium specimens have been deposited in the herbarium of the Arnold Arboretum.

The cultivar name 'Vardar Valley' is being used for this taxon under the provisions of paragraph iii of Article C. 3, Section B of the International Code of Nomenclature for Cultivated Plants (Edition edited by Wm. T. Stearn, 1953). *Buxus sempervirens* 'Vardar Valley' would be assigned to the typical variety on the basis of material we have grown at the Arnold Arboretum. Dr. Anderson states, however, that the natural populations of this plant in the area where it was collected showed a significant range of variation in size and form. *Buxus* 'Vardar Valley' was selected in the field as distinctive for horticultural purposes. It has retained these characteristics of horticultural value when grown at the Arnold Arboretum. It is now being propagated vegetatively and "maintained in cultivation" as a clone.

Because of its dwarf, flat-topped habit and because of its demonstrated hardiness, *Buxus sempervirens* 'Vardar Valley' can well have a long and prosperous future in American gardens of the North.

Donald Wyman

Note: Unfortunately, this boxwood is not yet ready for distribution from the Arnold Arboretum. It is available from one commercial source, and in a few years will be from others, we hope. No propagation material of this plant is available from the Arboretum this year.

ARNOLDIA

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ASIATIC MAPLES,
THEIR PROPAGATION FROM SOFTWOOD CUTTINGS

SINCE the trend of architecture today is to lower and more compact buildings in both the industrial and residential fields, attention has been focused on trees which at maturity reach a height of only eighteen to thirty feet. The towering elm, maple or oak which were most frequently planted a generation ago tend to give a one-sided appearance to ranch-type houses or the modern one-story factories. In addition to this, there are two relatively new problems to be met; that of the hurricanes of recent years which destroyed many large trees and caused heavy damage to utilities from falling trees and limbs and the high mortality among our native elms due to Dutch Elm Disease.

Smaller trees would be in scale with new factories and homes. They would be below utility lines at maturity thus decreasing considerably the damage to these lines by acts of nature and they would lessen tremendously the maintenance costs of street tree plantings. They would also be much easier to keep disease- and insect-free.

As interest increased in the use of smaller trees for landscaping and street tree planting, a comparable interest grew in the methods by which these plants could be propagated.

One of the largest groups of "small" trees is a group of plants known as the Asiatic Maples. Though not all maples indigenous to Asia are small, there are a goodly number which at maturity are only eighteen to thirty feet tall. This is quite small when compared with the height of our native Norway, Sugar and Silver Maples, which range from 70 to 120 feet.

In considering the propagation of Asiatic Maples one would assume that the easiest and cheapest way to reproduce these plants would be from seed. This conclusion is certainly true and when seed is available the plants should be prop-

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agated from seed. However, many of the maples mentioned herein are found only as specimen plants in botanical gardens and arboretums, certainly not enough plants to supply the quantity of seed necessary for commercial propagation.

In addition to the limitations of a small number of available stock plants, those that are available do not produce a crop of seed every year. Many times two to five years will elapse between good seed years.

It was felt, therefore, that while seed propagation remained a cheap and successful method for reproducing these plants, if a seed supply was available, another method should be found which would be more reliable on an annual basis. With this idea in mind, experimental work was conducted on the rooting of Asiatic Maples from softwood cuttings. The procedure employed and the results obtained were as follows:

Cutting material was collected, in most cases, from mature plants, 19 to 39 years old, growing in the Arboretum's collections (see Table I). However, in order to obtain a rooting comparison between the cuttings collected from mature plants and cuttings collected from young plants, material was also taken from young seedlings varying in age from two to eight years.

It is a known fact that in some instances cuttings taken from juvenile plants root much more readily than the same type of cuttings taken from mature plants. This statement holds true even when the cuttings collected from both types of stock plants are handled in an identical manner. In the rooting of softwood cuttings of Asiatic Maples the age of the stock plant has a very definite effect upon the rooting results. The older the stock plant, the less successful rooting will be.

In addition to collecting the cutting material from plants of varying ages, cutting material was also collected at different times throughout the growing season, especially during the early spring months. This latter operation was carried out in order to determine what effect, if any, timing had upon the rooting of these cuttings. In three instances the cutting material was collected as soon as there was enough new growth on the stock plants to make a cutting (see Table I).

The cutting material was made up exclusively into tip cuttings. In no instance were the soft terminal leaves pinched out. The cuttings varied from two to five inches in length and contained anywhere from four to six leaves. Once the material had been made up into the proper type of cuttings, the latter were treated with a variety of root-inducing hormones to determine which hormone, if any, was beneficial to rooting.

All of the root-inducing hormones used in this experiment were in powder form and were applied by dipping only the basal end of the individual cutting into the dry powder; the ends of the cuttings were dipped into water prior to being dipped into the hormone powder. In spite of the various kinds of propagating material used and the different times throughout the growing season when the cutting material was collected, one hormone concentration consistently gave good rooting results. This was indolebutyric acid in talc at a concentration of 0.8 mg./gm.,

which is the same concentration as the commercial powder Hormodin #3. A number of other hormone concentrations were tried. Some proved too strong, such as the one and two percent concentrations of indolebutyric acid in talc, and the green liquid hormone "Chloromone"; others proved too weak, such as the talc preparations of indole-3-acetic acid. For this reason, the only results shown in Tables I and II are those obtained with Hormodin #3.

One other point should be stressed here in connection with the root-inducing hormones and that is the practice of wounding. In two instances (see Table I), wounding was employed with very favorable results. As is often the case with material which is hard to root, the practice of wounding definitely stimulates rooting. This is due to the fact that the hormone powder is brought into contact with a greater area of the cambium layer on the wounded surface. By exposing a greater area of the cambium layer to the hormone powder, the callusing action is speeded up and rooting stimulated.

Wounding was accomplished by removing a small piece of bark and wood from one side of the cutting, at the basal end (see Plate XI). This piece of wood is approximately three-quarters to one inch in length and one-sixteenth to one-eighth of an inch in thickness. The actual cut is not deep, being just deep enough to expose the cambium layer.

In both instances where wounding was employed in conjunction with the rooting hormone Hormodin #3, the results were significant enough to lead one to think that perhaps all of the different kinds of Asiatic Maples in this experiment might have benefited from such a treatment. The answer to this lies in the experimental work scheduled for the spring and summer of 1957.

Following the treatment with different hormone concentrations, plus a wound in two instances, the cuttings were inserted into a medium of coarse sand. This operation was done in two locations. The first was in a six-inch-deep cutting bench where the bottom heat was supplied by a lead cable thermostatically controlled and the second was in a standard greenhouse flat measuring three inches deep, twelve inches across and twenty-four inches in length. Once filled with cuttings, these flats were placed on a greenhouse bench where the bottom heat was supplied by hot water pipes. The heat was retained beneath the cuttings by using polyethylene plastic to enclose the bottom of the benches. The cuttings were then flooded with water and a light wire frame constructed of "turkey wire" was placed over them. These wire frames measured eight inches above the surface of the medium. The "turkey wire" is a number nine gauge and can be purchased in four foot rolls. The individual wire squares are two by four inches. Bought in this size, the wire can be cut and bent into any desired shape or size.

After the wire frames were placed in position over the cuttings, they were covered with sheets of polyethylene plastic in such a manner that the individual sheets overlapped. If the plastic is placed in this way, there is no need of applying adhesives to hold the sheets together. With a large overlap, the individual

sheets of plastic stick together quite readily after they have once been moistened. Once covered, the cuttings require little further attention.

Due to the fact that polyethylene plastic retains water vapor while allowing air to pass through, though at a very slow rate, the medium requires no additional watering for a period of from three to five weeks. Naturally, the hotter it is the more rapidly the medium will dry out. However, the plastic will trap heat, especially during the hot summer months, and *this is its biggest disadvantage.* For this reason the shading conditions must be watched very closely. In general, during the summer weather, the lath shading covering the greenhouses is sufficient to hold the temperature below ninety degrees under the polyethylene plastic. However, when the days are exceptionally hot, ninety degrees and over *outside*, additional shading is required to keep the cuttings from burning. This shading is provided by placing one layer of Saran cloth, of a thickness that allows 52 percent of the available light to pass through, directly on the plastic cases themselves. This additional shading is provided only from noon to five o'clock.

Once rooted, the cuttings were potted in $2\frac{1}{2}$-inch standard pots. The potting mixture was of a very light texture, consisting entirely of decayed leaves and weeds from a compost pile. Following this, the cuttings were placed on an open greenhouse bench where they were again covered with "turkey wire" frames. During the ensuing 7- to 10-day period, the plastic was taken off a little each day depending upon the weather, so that by the end of this time the plastic had been entirely removed. The wire frames were also removed at this time. This step is extra, one which most nurserymen do not carry out. However, I feel that it is more than worth the extra time involved not only because of the high survival percentages obtained with our newly-potted cuttings, but also because many of the rooted cuttings handled in the above manner will break into growth once they have become established. This is especially true of cuttings taken in the early spring months (see Table I).

After the potted cuttings have been hardened off they remain on the greenhouse benches until the early fall, at which time they are moved either into a pit house or into cold frames. The pit house is unheated and the potted cuttings are over-wintered on open benches, three in a tier on each side of the house. If the potted plants are over-wintered in cold frames, they are plunged in sawdust to prevent them from heaving and drying out too fast. The potted cuttings remain in these structures until the following spring, at which time they are planted directly into open nursery rows. Table I lists the results obtained with softwood cuttings taken from mature plants nineteen to thirty-nine years old which are growing in the Arboretum's collections.

In reviewing these results, it is interesting to note that the practice of wounding was very beneficial in the two instances it was tried (see *Acer capillipes* and *Acer cissifolium*). In these two instances, rooting was much heavier on the wounded cuttings than on the cuttings which had been treated with the rooting hormone only.

Another observation from Table I based on the rooting comparison between cuttings made in May–June with those made in July–August indicates that most of the cuttings were taken too late in the season for maximum rooting results. Where soft, immature wood was used, rooting results were very good. This point is emphasized by the results obtained with *Acer cissifolium* and *Acer tataricum* (see Table I). In these two cases the cuttings were made in May. Not only did they root extremely fast and fairly well, but they also went on to grow during the same season.

This ability of the cuttings to grow following rooting is one of the most important factors in the use of polyethylene plastic for the propagation of softwood cuttings. Not only does the plastic, with its unique properties, create conditions suitable for the rooting of very soft, immature cuttings, but it also creates the conditions necessary to stimulate the newly-rooted cuttings into vegetative growth. Handled in this manner, the cuttings *in most cases*, will be larger than a seedling of the same species at the end of the first growing season.

Table II shows the rooting results obtained with soft, immature cuttings taken from young seedlings which were forced in the greenhouse. As mentioned previously, these cuttings were taken in order to obtain a rooting comparison between cuttings taken from young stock plants two to eight years of age and those taken from old stock plants nineteen to thirty-nine years of age. The results shown in Table II clearly indicate that while cuttings taken from older plants root fairly well, especially in some instances, the rooting results obtained with cuttings taken from forced young seedlings are far superior. I have never been one to put much stress on the percentage obtained in rooting cuttings since I feel that we do not root sufficiently large quantities of cutting material to quote percentages, but I do feel that if the rooting results indicated in Table II for a specific plant are compared with the rooting results indicated in Table I for the same plant, it is easy to see that the age of the stock plant has a great deal of effect upon the rooting results. *Acer buergerianum* is a good example of this.

In addition to the favorable rooting results obtained with softwood cuttings taken from forced young seedlings, these small rooted cuttings will grow anywhere from four to fifteen inches the same season in which they are rooted. Of course, it is not commercially feasible to force young seedlings into growth during the early spring months in order to make softwood cuttings from this forced growth. However, it is certainly feasible to make softwood cuttings from these same seedlings out-of-doors during the months of May and June and obtain similar rooting results. The only differences will be in the amount of vegetative growth which these rooted cuttings will make during the summer. Although they will grow, the growth will not be so great as when the cuttings are rooted during the months of March and April in the greenhouse.

We have not yet been able to root *successfully* all of the Asiatic Maples which we have tried, due to a variety of reasons. First and foremost is the inability to

obtain young stock plants. The stock plants which we have worked with in these instances are relatively old (fifteen to thirty-five years); consequently, cutting material collected from these plants roots very poorly, if at all. In addition to this, in some experiments the quantity of cutting material employed has been too small to give us significant results. Last of all is the fact that the timing in the collection of these cuttings was not correct. Many times the cuttings were made from half-ripened or fully ripened wood during the months of July, August and September and for this reason they did not root.

Table III lists the Asiatic Maples tried only on a limited scale and the results obtained.

Summary

If a supply of seed is lacking, the propagation of Asiatic Maples from softwood cuttings is quite feasible. The procedure mentioned herein is certainly more expensive and time-consuming than growing these same plants from seed. However, the expense is offset, in part at least, by the fact that one does not have to wait until every second, third or fourth year in order to obtain a good supply of seed; and secondly by the fact that *taken early enough in the season*, a softwood cutting will, in most cases, outgrow a seedling during the first growing season.

The advantage of making softwood cuttings from young plants is easily seen when the rooting results of Table II are compared with those of Table I. While in every case the softwood cuttings taken from the younger stock plants rooted better, there were two cases where the cuttings taken from older stock plants rooted fairly well. I refer to the results obtained with *Acer cissifolium* and *Acer capillipes*. It also should not be overlooked here that, in both of these cases, the cuttings were wounded. Just what effect wounding would have had upon the rooting results obtained with the other maples attempted is highly speculative. However, there is no doubt that in the two instances where it was employed, rooting was stimulated.

In all of these experiments the use of manufactured rooting hormones was varied and extensive, but in most instances, the best rooting results were obtained with the commercial preparation Hormodin #3 (0.8 percent indolebutyric acid in talc).

The preceding pages describe one technique by which Asiatic Maples may be propagated. This method will not replace or supersede the propagation of these plants by seed, but it can and should be used to reproduce them on a more regular schedule. The last and probably most important factor in favor of propagating these plants from softwood cuttings is the fact that for many of them *there is no commercial supply of seed available anywhere.*

Roger Coggeshall

PLATE XI

Wounding technique employed with Asiatic Maples. (*Acer cissifolium; Acer capillipes.* See Table I.)

TABLE I — Rooting results with softwood cuttings taken from mature plants of Asiatic Maples.

Name	Age of Plants	No. of Cuts	Treatment	Results			Date Made	Date Potted	Remarks
				Rooted	Callused	Dead			
Acer barbinerve (Manchuria)	39 years	100	Hormodin #3	87	7	6	8/8/56	10/10/56	Cuttings rooted in flats of sand, due to lack of space in the cutting benches.
Acer buergerianum (China)	19 years	100	Hormodin #3	11	84	5	7/6/54	10/15/54	Very little callus on unrooted cuttings. Cuttings taken too late.
Acer buergerianum (China)	19 years	100	Hormodin #3	6	92	2	8/16/55	12/29/55	Cuttings callused heavily, but taken too late in the season.
Acer buergerianum (China)	19 years	100	Hormodin #3	19	73	8	8/5/56	11/10/56	Taken too late in the season.
Acer capillipes (Japan)	37 years	100	Hormodin #3 plus wound	91	7	2	8/17/56	10/20/56	Rooting very heavy. Uniform root system. Wounding definitely beneficial.
Acer carpinifolium (Japan)	37 years	100	Hormodin #3	69	14	17	5/23/55	8/10/55	Cuttings badly burned due to lack of shade. Only 2–3 roots/cutting.
Acer carpinifolium (Japan)	37 years	200	Hormodin #3	158	24	17	8/8/56	11/14/56	Possibly better results if the cutting were taken sooner.

Acer cissifolium (Japan)	37 years	100	Hormodin #3	72	24	4	5/11/54	6/13/54	Cuttings were 12″–15″ high at the end of the growing season, same season they were rooted.
Acer cissifolium (Japan)	37 years	140	Hormodin #3 plus wound	91	7	2	8/18/55	10/6/55	Good heavy root system. Wounding definitely beneficial.
Acer cissifolium (Japan)	37 years	200	Hormodin #3	56	123	21	8/9/56	8/30/56	Unrooted cuttings dropped their leaves and went into dormancy. Taken too late in the summer.
Acer tartaricum (Western Asia)	26 years	100	Hormodin #3	63	28	9	8/16/55	10/14/55	Very heavy root system (3–8 roots/cutting).
Acer tataricum (Western Asia)	26 years	100	Hormodin #3	77	11	12	5/10/56	5/25/56	Cuttings were 6″–10″ high at the end of the growing season, same season they were rooted.
Acer tegmentosum (Manchuria)	31 years	75	Hormodin #3	67	4	4	8/15/56	9/17/56	Two-year wood at the base of cutting rooted best.
Acer triflorum (Manchuria)	33 years	100	Hormodin #3	0	83	17	7/9/54	8/10/54	Taken too late in the season. Leaves turned yellow and fell off.
Acer tschonoski (Japan)	39 years	100	Hormodin #3	36	41	23	8/15/56	10/18/56	Cuttings taken too late.

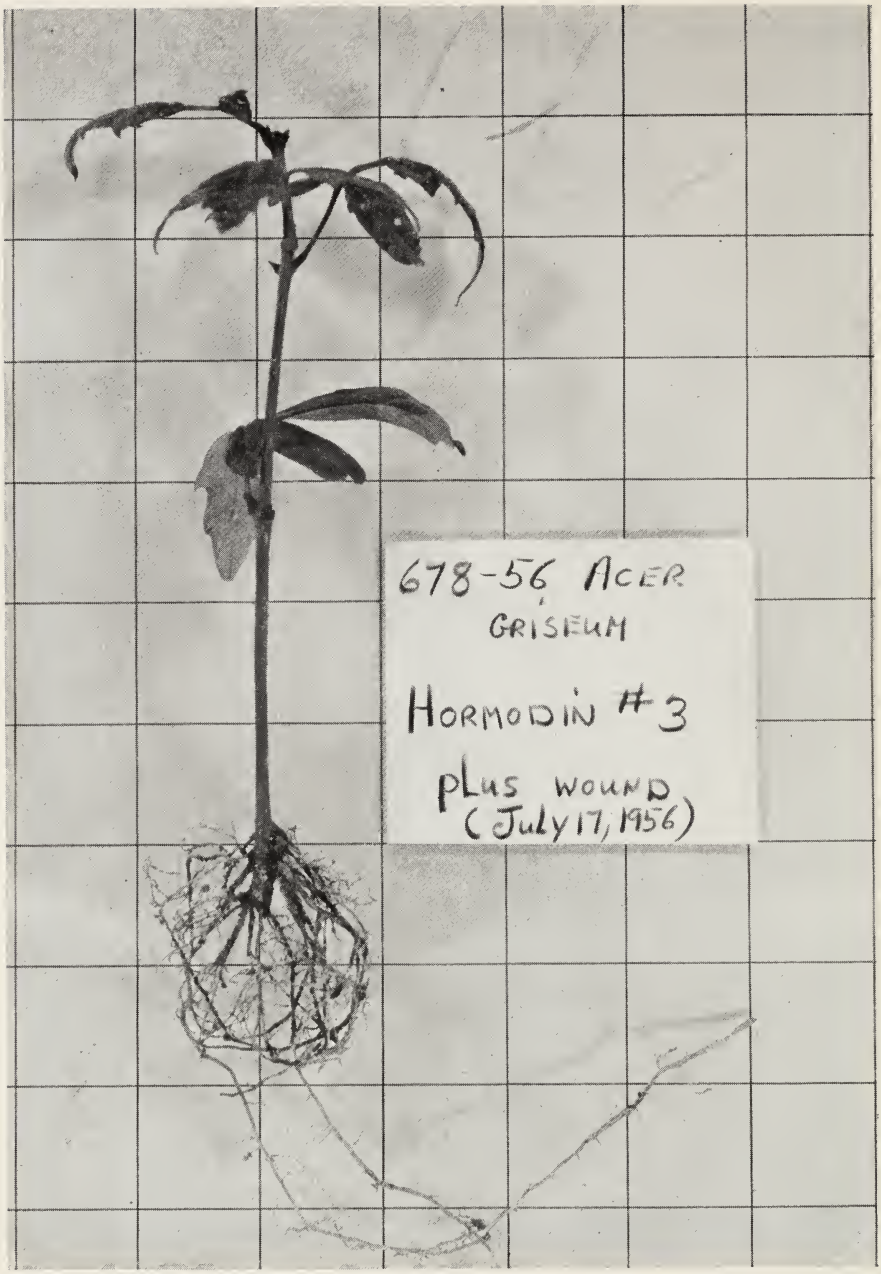

PLATE XII

Photograph taken three months after cutting was potted. Medium: Sand. (*Acer griseum*. See Table III.)

TABLE II — Rooting results with softwood cuttings taken from young seedling Asiatic Maples forced in greenhouse.

Name	Age of Plants	No. of Cuts	Treatment	Results			Date Made	Date Potted	Remarks
				Rooted	Callused	Dead			
Acer buergerianum (China)	2 years	100	Hormodin #3	94	6	–	6/18/56	8/21/56	Cuttings rooted heavily (4–7 roots/cutting).
Acer ginnala (China, Japan)	3 years	100	Hormodin #3	87	13	–	2/2/55	2/23/55	Two to three roots per cutting.
Acer ginnala (China, Japan)	3 years	100	Hormodin #3	92	8	–	3/16/56	4/11/56	Untreated cuttings rooted nearly as well as treated cuttings.
Acer triflorum (Manchuria)	2 years	100	Hormodin #3	77	8	15	2/1/55	2/23/55	Cutting material very soft and succulent.
Acer triflorum (Manchuria)	2 years	100	Hormodin #3	83	11	6	2/11/56	3/21/56	Cuttings rooted very heavily (3–6 roots/cutting).

TABLE III — Results of preliminary rooting experiments with some hard-to-root Asiatic Maples.

Name	Age of Plants	Lot No.	No. of Cuts	Treatment	Results			Date Made	Date Potted	Remarks
					Rooted	Callused	Dead			
Acer griseum (China)	10	1	15	Full strength Chloromone plus wound	–	–	15	7/17/56	–	Hormone concentration much too strong. Cuttings all killed by Aug. 1, 1956.
		2	15	Half strength Chloromone plus wound	–	–	15	7/17/56	–	Hormone concentration too strong. Cuttings all killed by Aug. 15, 1956.
		3	15	Hormodin #3 plus wound	5	10	–	7/17/56	8/21/56	Fair root system. (see Plate XII)
Acer grosseri hersi (China)	32		25	1% Indolebutyric acid in talc	10	15	–	9/23/55	10/10/55	Unrooted cuttings heavily callused.
Acer mandshuricum (Manchuria; Korea)	49	1	20	Hormodin #3	1	16	3	5/18/55	10/14/55	Rooted cutting failed to live through winter 1955–56.
		2	10	Control (No treatment)	–	10	–	5/18/55	–	Heavy callus.
Acer miyabei (Japan)	54	1	25	Hormodin #3	–	14	11	5/18/55	–	Heavy callus.
		2	25	Hormodin #2	1	10	14	5/18/55	8/10/55	Lightly rooted.
		3	25	Chloromone (Half strength)	11	–	14	5/18/55	8/10/55	Uniform root system on cuttings.
		4	25	Control (No treatment)	–	16	9	5/18/55	8/10/55	Heavy callus.

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THE NEW HORTICULTURAL COLOR CHART

"THE time has come for American Horticulture to adopt some uniform standard by which color can be accurately measured and uniformly judged and described the country over. Many industries have done this. Horticulture seems to be far behind. . . . Those of us who are constantly studying plants realize better than most, the necessity for having an accurate standard by which we can compare the colors of flowers, foliage and fruit, and afterwards to describe those colors in uniform terms understood by other individuals who have not seen the plants themselves."

This statement appeared in *Arnoldia* in 1947 and is just as true today. It was written in an article describing the Royal Horticultural Colour Chart, and it was hoped at that time that this would be the chart which would become accepted in America. However, with no organization to champion this chart in America, with its comparatively high price, and with practically no American publicity and hence its unavailability, it has not become widely used.

The American Horticultural Council became interested in this color problem in 1949, and since that time has been studying various charts and possibilities for publishing charts in the hope that finally it would be able to have an accurate chart that would prove satisfactory for all horticultural needs, and at the same time stay within the limits of a moderate price.

The Nickerson Color Fan, just published and now available to horticulturists through the American Horticultural Council's Office at the Arnold Arboretum, is just such an accurate but reasonably-priced chart. It folds into a booklet 7½ inches long by 1¾ inches wide, which fits easily in any pocket or handbag. It contains 262 colors of 40 hues. It is available for $5.00 postpaid, is sponsored by America's outstanding color foundation, and can well become the standard for all American horticultural interests.

Included with this color chart is a twelve-page booklet explaining the use of

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this fan in detail. Printed in small letters on each color, is the popular color name and its numerical designation in the Munsell color system, which is fast becoming accepted as standard by many industries and societies dealing with color systems in America. The chart uses simple color names that have been selected as standard by the Inter-Society Color Council and the National Bureau of Standards.

The numerical color system may seem a little complex at first, but as one uses this chart and becomes familiar with it, this system is the means for estimating the value of colors which may not appear in the chart but do appear in the flowers or fruits being studied. With practice, the notation may be used to express as fine a color difference as the eye can see. As knowledge is gained of the principles upon which the Munsell system of notation is based, visual judgements of the amount and direction of the departure of the samples from the scale colors can be made and recorded by reference to the notations on the scales. There should be no difficulty for observers with normal color vision to agree regularly on the nearest hue and value, and within reasonable limits, on the closest chroma. It is this factor of one's being able to estimate colors accurately according to this numerical system which makes the chart so valuable.

There is a great disparity in color terminology, especially in horticultural circles. For instance, *Cercis canadensis* has been described by various authors as having flowers that are "pink flower bud, deep red calyx," "rose pink to purplish," "pink to purplish pink," "reddish purple or pink," "red," "rosy pink," or "bright pink to purple." By the use of this chart it will be noted that they should be described as being a moderate purplish pink (2.5 RP 7/7). In this way, although the common general color name is given, so is the accurate Munsell number which refers to a particular color hue, color value (lightness of color) and chroma or saturation of color. About such a particular determination there can be no question. When one reads such a description, he can refer directly to the color chart and determine the exact color being described to his own satisfaction.

The Nickerson Color Fan can be opened up into the form of a complete wheel. If wanted, a form is obtainable on which all of the leaves can be pasted to form the complete color wheel. This type of chart is necessary frequently in studying complementary colors for flower arrangements. However, the ease with which the fan can be folded and carried in the pocket makes it of inestimable use as a reference in the field as well as indoors.

The American Horticultural Council asked Miss Dorothy Nickerson to discuss color and color charts at one of its first meetings in 1949. Since that time, Miss Nickerson, who is Color Technologist in the United States Department of Agriculture in Washington, has become intensely interested in horticultural needs for a standard chart. Being a trustee of the Munsell Color Foundation, she was able to bring the need for such a chart before the Munsell Foundation. This is a private, non-profit foundation, owning the Munsell Company, established to further research in color. The chief tasks laid down for the Munsell Color Company by

PLATE XIII

The Nickerson Color Fan, a new horticultural color chart.

the Foundation are to develop and supply accurately-controlled color standards at near cost and to supply literature for describing the Munsell System and its application. Plans call for the publishing at some later date of three additional fans: one low chroma fan of ten hues, a moderate chroma fan of twenty hues, and a fan of near whites. However, these will probably not be available for some time.

The American Horticultural Council was given a grant last year by the Longwood Foundation, to be used specifically for this color fan. Because of this grant, these fans are now available from the American Horticultural Council. The Munsell Color Company has given the Council the distribution rights to all horticulturists and horticultural organizations in America (except the American Orchid Society). Horticultural organizations wishing to sell the fans to their own members can order in large amounts at special discount rates from the American Horticultural Council Secretary's office. To all others, the price is $5.00, postpaid.

For those who have used the Royal Horticultural Society's Colour Chart, there is included with every Nickerson Color Fan a table of conversion data, so that notations made from the Royal Horticultural Society's Color Chart can be quickly converted to the Munsell notations used on this new color fan. This, then, is an accurate means of determining colors indoors and out. It is readily available, practical to use, and considering the number of colors, comparatively inexpensive. This new color chart, it is hoped, will quickly become a common reference tool in American Horticulture.

Donald Wyman

A Reminder of Fall Classes at the Arnold Arboretum

Three classes will be offered this fall at the Arnold Arboretum. All classes are informal and are open to anyone interested in plants and gardening. Application for registration should be addressed to Miss Martha Burow, Arnold Arboretum, Jamaica Plain 30, Massachusetts.

British Botanical and Ornamental Gardens Instructor: Dr. Jarrett

5 sessions. Wednesday afternoons, 2:30–4:30, Nov. 6–Dec. 4. Fee $10.00

Fall Field Class in Ornamental Plants Instructor: Dr. Wyman

6 sessions. Friday mornings, 10–12, Sept. 27–Nov. 1. Fee $2.00

Plant Propagation I Instructor: Mr. Coggeshall

6 sessions. Wednesdays, Oct. 2–Nov. 6. Fee $10.00
(morning session, 9:30–11:30) (evening session, 7–9)

Because of unforeseen circumstances, Dr. Howard's class in "Ornamental and Economic Plants in Florida and the West Indies" will have to be cancelled.

ARNOLDIA

A continuation of the
BULLETIN OF POPULAR INFORMATION
of the Arnold Arboretum, Harvard University

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BROAD-LEAVED EVERGREENS IN THE ARNOLD ARBORETUM

NOW is the time of the year when the broad-leaved evergreens truly come into their own. All year long they have been growing, but often they are outshone in the garden during spring and summer by the deciduous flowering trees and shrubs which frequently bring bright colors into the plantings. When winter winds and winter cold remove all the leaves from these deciduous plants, the broad-leaved evergreens assist in keeping the garden green and "alive" throughout the long, winter months.

New England is a difficult place in which to grow these plants, but it is surprising how many can be grown here with a little effort. In the Arnold Arboretum are well over a hundred species and varieties (not counting the many varieties of the broad-leaved, evergreen rhododendrons). It is true that during some winters the leaves of some are burned, either by exposure to sun in the late winter months or exposure to high, drying winds in late winter and early spring. However, with a little forethought in locating these plants in the proper place, many of them can be expected to appear at their best throughout the trying cold winter.

Temperatures here in the winter are erratic, to say the least. Last winter, for instance, the lowest was in the neighborhood of -20° F., while in January, the highest was about 58° F. Droughts also can work much harm to the evergreens, regardless of whether they come in winter or in summer. Last summer, for instance, with only four inches of rain in four months, the evergreens stood a chance of much winter injury. Happily, enough rain came in the latter part of October and November, so there is a likelihood that they will go into the winter with sufficient moisture about their roots, although it is difficult to foretell whether the extensive drought before that time will result in noticeable damage next spring.

The plants listed in the following pages are some of the broad-leaved evergreens growing in the Arnold Arboretum. The list will be of interest to many as one from which suggestions can be taken for planting under certain types of conditions.

GRAY HERBARIUM
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JAN 2 1958
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Andromeda glaucophylla 1′–2′ Zone 2 Downy Andromeda

Not particularly meritorious as an ornamental, but extremely hardy. Native throughout the entire Northeastern Area from Labrador to New Jersey, this plant with its small brownish leaves, white on the undersurface, is best used in swampy situations.

Arctostaphylos uva-ursi 6″–1′ Zone 2 Bearberry

An excellent ground cover especially for dry, sandy soils, this also is an American native from coast to coast. The creeping stems are covered with dark green leaves about the size of those of boxwood. In the fall, they turn a rich bronze that holds for the rest of the winter. Rather slow growing, the bearberry produces bright red berries in the fall, grows in acid soils, and often clambers over rocks. I have seen the bears in the Canadian Rockies eating the fruits with much apparent relish. It should be remembered that this is hard to transplant, especially from the wild, so that plants grown in pots are best relied upon for original planting. Although it withstands shade, it will thrive in full sun, and is frequently seen in the high mountains of the Northwest as well as along the sandy hills of the eastern seashore areas.

Berberis buxifolia nana 18″ Zone 5 Dwarf Magellan Barberry

One of the very few plants from South America growing in the Arboretum, this small, evergreen barberry is not reliably hardy here, but makes a dense mass of foliage where it survives.

Berberis chenaulti 6′ Zone 4 Chenault Barberry

This hybrid of two excellent evergreen barberries (*B. verruculosa* × *gagnepaini*) certainly has hybrid vigor and is easily one of the most vigorous growing of the evergreen barberries. Unfortunately, commercial growers have not propagated it to any great extent, but if and when they do, it will quickly become extremely popular with the public. The long, narrow, spiny leaves that are grayish green in color, the vigorous shoot growth and pale blue fruits as well as the small yellow flowers, all go to make it an excellent plant. Seldom have we seen it injured from winter burning in the Arboretum.

Berberis gagnepaini 6′ Zone 5 Black Barberry

This bushy evergreen from China, introduced into this country by the Arnold Arboretum, does well in the gardens of New England as well as those of California. It needs good soil to produce the best foliage. The narrow, evergreen leaves are sometimes as much as four inches long.

Berberis julianae 6′ Zone 5 Wintergreen Barberry

Of very dense habit this is one of the hardiest evergreen barberries and usually

PLATE XIV

Left: *Mahoberberis aquisargenti*, a new, hardy, broad-leaved evergreen.

Right: *Cotoneaster microphylla cochleata*, one of the fine varieties of the small-leaved cotoneaster.

a strong grower, although *B. chenaulti* seems to be slightly more vigorous. Like all these evergreen barberries, it is extremely thorny.

Berberis sargentiana 6′ Zone 6 Sargent Barberry

This used to be a popular favorite in this group, but during the past few years, it has not performed as well as other evergreen barberries. One of the reasons is that it is not quite as hardy as the others. Farther south it may well grow into a vigorous, six-foot shrub, but it does not do too well here in New England.

Berberis triacanthophora 4′ Zone 5 Threespine Barberry

Another of the hardy, evergreen barberries, E. H. Wilson, who introduced this from Central China in 1907, considered this the most hardy of all the Chinese species. The long spines are most conspicuous and very effective, but it does not have the dense growth of *B. julianae* and *B. chenaulti.*

Berberis verruculosa 4′ Zone 5 Warty Barberry

The warty barberry is one of the best, with its low, compact habit and its glossy green leaves which are white on the underside, making it decidedly ornamental. Although it can grow to four feet in height, most plants in this area are much less. It must be said that the yellow flowers and bluish fruits of all these evergreen barberries, add to their beauty and ornamental usefulness.

Buxus microphylla koreana 4′ Zone 5 Korean Box

This variety was widely recommended, especially by E. H. Wilson, as the hardiest of all boxwoods. This may be true, but it certainly is not the most ornamental, especially in the winter. The small leaves frequently turn brownish in the fall and stay that way all winter. Now that *Ilex crenata convexa* is known to be as hardy, certainly is more vigorous growing, and especially since it keeps the dark green color of its leaves all winter, this hardy and better-looking substitute has often been used in place of the Korean box. Korean box should not replace the English box wherever that excellent plant is hardy ; rather, it should only be used on the northern limits of its English relative, if it seems desirable.

Recently, a variety of *Buxus microphylla* originated on Long Island and has since been named 'Tide Hill.' Plants of this are apparently very low, for the original in western New York, when it was measured in 1954, was 5 feet across but only 15 inches tall at the age of about 20 years.

Buxus sempervirens 10′ Zone 5 Common Box

The popular English box is widely grown in America wherever it proves hardy. It has its troubles, but there is nothing quite like this species for excellent dark green, aromatic foliage, dense growth, and a splendid ability to withstand all types of shearing. Although it has been tried in all sorts of places in New Eng-

land, the concensus of opinion is that *Buxus sempervirens* and its many standard varieties are just not reliably hardy in New England's rigorous climate. Old New England sea captains brought back plants to this area, as did some of the early settlers, but usually they all eventually suffer winter injury.

However, there is still enough doubt in the minds of some experimentally-minded individuals to induce them to grow different clones (either imported or raised from seed) in an attempt to find an English box plant that is truly hardy throughout New England. Several possibilities have appeared. To prove the hardy character of some of these newcomers, the Arnold Arboretum is growing some of the standard varieties of *B. sempervirens* like *angustifolia*, *arborescens*, *handsworthi*, *rotundifolia* and *suffruticosa*. In extremely cold winters, these are injured. Some of the newer varieties are 'Curlylocks,' 'Kingsville,' 'Northland,' 'Inglis' and 'Vardar Valley.' The variety 'Inglis' originated in central Michigan where it has withstood winter temperatures of −20° F. each year for many years, without injury. The variety 'Vardar Valley,' recently described in *Arnoldia*, comes from a cold part of the Balkans, its native habitat, and has performed well here since 1935, when cuttings from the original plant were first introduced.

Chamaedaphne calyculata 1′–2′ Zone 2 Leatherleaf

This native plant is not a good ornamental evergreen, for it does not produce too many leaves, and in the winter, these are brownish. It is best used in moist situations, but is hardy well up north into Zone 2.

Cotoneaster dammeri 1′ Zone 5 Bearberry Cotoneaster

One of the few, low, distinct evergreen cotoneasters, this has a prostrate, trailing habit. It makes an excellent slow-growing ground cover and is well adapted for use in the rockery.

Cotoneaster microphylla 3′ Zone 5 Small-leaved Cotoneaster

The small-leaved cotoneaster is another evergreen with leaves about one-half inch long and less than that in some of the varieties. It can build itself up into a tangled mass of branches one or two feet high and as much as 15 feet in diameter. It has the smallest leaves of any cotoneaster and so is valued in rock gardens and for a foliage mat in the foreground of the shrub border.

Daphne cneorum 6″ Zone 4 Rose Daphne

The rose daphne, seldom over six inches tall, is conspicuous in any garden when it is in full flower. There is always the argument as to whether it does best in acid or alkaline soils; it has done well in both. As a matter of fact, all members of this genus are sometimes extremely difficult to cultivate and may suddenly die after several years of apparent perfect growth. A cool moist condition about the roots and some winter protection in the North are suggested to insure good growth.

Euonymus fortunei 4″ Zone 5 Wintercreeper

The wintercreeper clan contains some excellent broad-leaved evergreens, but it should be remembered at the start that they are all susceptible to infestation of the *Euonymus* scale, and so, in areas where this can be a real pest, it might be well to overlook these plants for planting in the garden. All are clinging vines, but a few are semi-shrubby. The variety *vegeta* is one example, for it can grow into a procumbent shrub four feet tall. This is one of the varieties that bears fruit — orange capsules which crack open to display bright orange fleshy fruits inside that are most ornamental. This variety was first introduced into America by the Arnold Arboretum in 1876, and has proved very popular ever since.

Another shrubby form is the variety *carrierei* which has leaves that are longer and more pointed than those of the variety *vegeta*, and not as leathery. This form, too, can produce fruits. Old plants of this, and in fact, other forms of this species as well, frequently "sport"; that is, branches are found here and there about the plant with foliage entirely different from the real specimen. It is not unusual to find three or four variants growing on the same plant.

The variety *colorata* is a fast-growing (for *Euonymus*) ground cover, with branches running flat along the surface of the ground. The leaves of this variety turn a rich purplish red in the fall and retain this color most of the winter; an excellent type for planting on banks or to grow over the top of large rocks.

Two small-leaved varieties and still in the broad-leaved evergreen class are *minima* and *kewensis*, the latter with leaves slightly smaller, usually about one-quarter inch across. These are both extremely slow-growing forms, good only for planting in the foreground of the rockery or on the foundation of buildings where they can be easily observed.

Two other varieties have variegated foliage—'Silver Queen' and *gracilis*. The leaves are variegated with a creamy white and are most prominent. There is not too much difference between these forms, although the leaves of 'Silver Queen' have pure white variegations, while in those of *gracilis* the color may be white, creamy white, or even a pale pink.

There are some new varieties of this species appearing in the nurseries, upright forms that are used for edging or very low hedges. These include 'Berry Hill,' 'Dupont,' 'Manhattan,' and others. Being varieties of *E. fortunei*, they are all included in this group of broad-leaved evergreens.

Gaultheria procumbens 3″ Zone 3 Wintergreen

This low native is seldom planted in gardens except in areas where natural-woods conditions are simulated. It requires very acid soil, moisture, and considerable shade to thrive.

Gaylussacia brachycera 18″ Zone 5 Box Huckleberry

If it were not for the extremely slow growth of this plant, it would be one of

PLATE XV

Top: *Viburnum rhytidophyllum.*
Bottom: *Euonymus* 'Silver Queen.'

the most popular of all evergreens. It is rarely found native in America, has been "lost" several times, and has the distinction of possibly being one of the oldest plants in North America. It spreads by underground rootstalks, and it is estimated that one stand in central Pennsylvania covering an area of 300 acres is all one plant, possibly as much as 5,000 years old. It is most difficult to propagate from seed and nursery stock is extremely limited. The leaves are small but very lustrous, and apparently are not injured here in New England by very cold winters, possibly because our plants are so low that they are covered with snow a greater part of the winter.

Hedera helix 6″-8″ (clinging vine) Zone 5 English Ivy

The English ivy is in the same category in New England as is the English boxwood, namely that neither is reliably hardy, but some gardeners are able to bring plants through winters in such excellent condition that many another gardener tries to do likewise. As a result, with this species, also, there is great interest in trying out new so-called "hardy" varieties. A few years ago, the hardiest was supposed to be the variety *baltica*, which is growing to the third story on the north side of our brick administration building. However, even in this protected place, occasionally this is badly defoliated by severe winter temperatures.

More recently, new varieties have appeared. The one originating in New York and named by the New York Botanical Garden, '268th Street,' is being tried side-by-side with 'Rumania' which was named by the Missouri Botanic Garden and is said to be hardy in the Midwest. It probably will take some years to make certain which is the most hardy under our conditions here in New England, but as yet, none has shown serious winter injury, although none of these newer forms has reached the great size of our *baltica*, hence none is as "exposed."

Ilex aquipernyi 6′ Zone 6

Since neither of the parents of this hybrid are completely hardy in the Arnold Arboretum, one would expect this to be tender also, and such is probably the case with the seven-year-old plant we have. It is now about five feet tall, with glossy green leaves, but it has suffered some winter burning of the foliage in the last few winters.

Ilex crenata 20′ Zone 6 Japanese Holly

The Japanese holly is a most useful plant, either as a specimen, massed, or used in hedges where it is closely sheared. It has a number of varieties. A few years ago it was noted that the "hardiest" variety was the little-leaved *microphylla*, but whether because of over-all milder climate or some other reason, other types also seem to be doing very well. We have a plant of the species about seven feet tall and one of the variety *latifolia* almost as large, as well as a seven-foot specimen of *microphylla*.

The variety *convexa* is to me the hardiest form here in New England, and without question, the best and hardiest substitute for boxwood. Arboretum visitors are well acquainted wtth the splendid old specimen along the Centre Street Path in the Arboretum, the original plant sent over by E. H. Wilson from Japan in 1919. The wide, vase-shaped habit, the excellent dark green leaves, and even the small black fruits in the fall, all go to make this one of the best of the broad-leaved evergreens for New England gardens. Admittedly, the flowers are inconspicuous, but it is not susceptible to any serious insect or disease pest, nor is it particular as to soil.

There are now growing in the collections or the nurseries of the Arnold Arboretum, some 25 varieties of *Ilex crenata*, some excellent plants, some of doubtful origin. Most are too small to tell much about their final habit, form, and hardiness; others have been thriving here for many years. A 23-year-old plant of *I. crenata helleri* is a dense, compact, rounded mass of leaves about one-half inch long. It is $3\frac{1}{2}$ feet tall but 6 feet in diameter. An 8-year-old plant of 'Green Island' is definitely flat-topped, with coarser leaves over an inch long, more open growth, wide spreading, 2 feet tall and 7 feet across. A 9-year-old plant of *stokesi* is compact, but showing a definite tendency to produce many upright shoots, $2\frac{1}{2}$ feet tall, 5 feet across, and leaves about one-half inch in diameter. The variety 'Glass' is merely a selection of the variety *microphylla*, and it is difficult to tell these two apart. Many of the others are dwarf types, and it is hoped that they will prove hardy, some being outstanding enough to merit continued garden use. 'Kingsville' and 'Kingsville Green Cushion' both are excellent types, and if grown in situations where they will not burn in the winter, merit the considered attention of those who like dwarf evergreen plants.

Ilex glabra 21′ Zone 3 Inkberry

A common native in the Eastern United States and Canada, this is a dependable, broad-leaved evergreen that does not necessarily have to be grown in swampy places. The dark, lustrous leaves, one to two inches long, are excellent all winter. The fruits are black, hence not conspicuous, and the plant normally grows with many stems directly from the base. Although it can grow as high as 20 feet, it is normally found in gardens considerably under 8 feet. If it grows too rank, it can easily be cut down to the ground and it will grow back very quickly in a more bushy condition.

There is a variety being offered in the trade which we have been growing since 1953, called *compacta*. After four years of growth, this is about two feet high and consequently looks as if it might have real possibilities as a dwarf plant. Other than height, its characteristics are the same as those of the species, except that the leaves are less than half the size of those of the species.

Ilex opaca 45′ Zone 5 American Holly

Although Boston is near the northern limit of the native American holly, it

certainly can be considered as a possibility for planting from here southwards. There are magnificent native stands on Cape Cod and in southern Rhode Island. There are, of course, many varieties available in the Eastern United States. Most are susceptible to infestations of the leaf miner which must be controlled. Normally, it grows best in acid soil. As is true with all members of the genus *Ilex*, the sexes are separate; both should be planted on the same property to insure fruiting unless there are male trees growing in the near vicinity, when only the pistillate form need be planted.

Ilex pedunculosa 30′ Zone 5 Longstalk Holly

This evergreen holly should be much better known. Young plants start to bear fruits when under five years old. The lustrous evergreen leaves are one to three inches long and the fruits are often as large as those of the English holly. This is a tree, not fast growing, since seven-year-old plants are usually under six feet tall, but nevertheless they are ornamental and well worth including among the valuable broad-leaved evergreens for this area.

Ilex rugosa 2′ (?) Zone 3

An extremely rare plant in America, this is a low prostrate shrub which can be used as a ground cover. The leaves are not over two inches long and the fruit is a red berry, but there are not many fruiting plants available in America today. It is very hardy, well up into Zone 3, and might well be used more.

Ilex sugeroki 2′–3′ Zone 5 Sugeroki Holly

Not many of these plants are available, either, and little can be said of the performance of this species in the Arboretum, since we have had it only for a few years. Pistillate plants produce red fruits, an excellent ornamental characteristic.

Ilex yunnanensis 12′ Zone 7 Yunnan Holly

The leaves of this species are about the size and shape of boxwood leaves and the fruits on the pistillate plants are bright red. However, although there has been a six-foot plant in the Arboretum for many years, it cannot be considered completely hardy in Boston; rather, it would best be used in Zone 7 or possibly Zone 6. Its neat, pyramidal habit of growth makes it an excellent ornamental.

Kalmia angustifolia 3′ Zone 2 Sheeplaurel

Of value only in acid-soil areas, especially those that are in wet soil. Not especially ornamental except as a plant for naturalizing, with evergreen leaves about $2\frac{1}{2}$ inches long.

Kalmia latifolia 30′ Zone 4 Mountain-laurel

A lovely native American evergreen, commonly grown in acid soils over a wide area in the Eastern United States. Much used in foundation planting, it can be

PLATE XVI

Top: *Vaccinium vitis-idaea minus* growing in foreground around the rock.
Bottom: *Rhododendron carolinianum* in the Arnold Arboretum.

restrained from growing to its maximum height by proper pruning in the very early spring. The deep-pink flowered form is most conspicuous, but it is extremely difficult to obtain from commercial sources.

Ledum groenlandicum 3′ Zone 2 Labrador Tea

Even though this is an extremely hardy evergreen, it is not a particularly ornamental type and can best be used only in peaty, boggy soils where few other plants will grow.

Leiophyllum buxifolium 18″ Zone 5 Box Sandmyrtle

The box sandmyrtle is a small evergreen best used in clumps, and might well be included in plantings of *Erica* or *Calluna* to provide variation.

Leucothoe catesbaei 6′ Zone 4 Drooping Leucothoe

If properly grown, this can well be one of the most serviceable and popular of broad-leaved evergreens. In its native habitat it can grow six feet tall, but in New England it grows entirely too open at the base to reach this height effectively. Rather, it should either be heavily pruned or else cut right down to the ground every few years so that the clumps grow no taller than about three feet. When grown in this way, it is always ornamental. The arching branches with their pendulous clusters of waxy white flowers in mid-spring are outstanding. The lustrous leaves are beautiful throughout the summer and they take on a rich bronze color in the fall and winter. When grown in a slightly protected place, with a small amount of shade, and if pruned as suggested, the drooping leucothoe can be one of the most beautiful evergreens out-of-doors, and will supply unlimited shoots for "arrangements" indoors, especially in the fall and winter months.

Mahoberberis aquicandidula 4′ (?) Zone 4 (?)
Mahoberberis aquisargenti 5′ (?) Zone 4 (?)
Mahoberberis miethkeana 5′ (?) Zone 4 (?)

These three new hybrids are doing very well in the nurseries of the Arnold Arboretum. The first two were imported from Sweden in 1948 by the Arnold Arboretum, and the third supposedly originated in the Miethka Nursery near Tacoma, Washington prior to 1948. It was not until June 1956 that they were judged resistant to the black stem rust of wheat by the Plant Pest Control Branch of the U.S. Department of Agriculture, but now they can be propagated and shipped interstate.

None of these three species has flowered in the Arboretum nurseries, but all look as if they were going to prove hardy in this area. The glossy, prickly leaves, dense habit of upright growth and apparent ability to retain their foliage in good condition throughout the winter, should make them valued ornamental evergreens. *Mahoberberis aquicandidula* is more difficult to propagate than *M. aqui-*

sargenti, and less interesting in the winter because of its smaller leaves and less vigorous growth. *Mahoberberis miethkeana* is very similar in foliage and habit, if not identical to *M. aquisargenti*. These three hybrids will be closely watched and compared during the next few winters to note differences in hardiness, since they are growing out-of-doors, together, under identical conditions of soil, moisture, and exposure.

Mahonia aquifoluim 3′, rarely 6′ Zone 5 Oregon Holly-grape

Some gardeners may have had difficulty with this plant retaining its leaves in good condition throughout the winter in New England. It is true that if given too much direct winter sun or planted in too exposed a position, the leaves may turn brownish, but if given some winter shade and planted in a protected situation, the Oregon holly-grape should be thoroughly evergreen. When plants are grown from seed, some forms may occur without lustrous leaves, but once the shiny-leaved forms are located, they should be propagated asexually, for the beautiful, dark leaves are one of its most important ornamental assets. This is another broad-leaved evergreen which, like *Leucothoe catesbaei*, should not be allowed to grow too tall, especially in New England. It is best kept under 3 feet in height. The bright-yellow flowers in mid-spring and light-blue, grape-like fruits in the early summer, add greatly to its effectiveness as a garden plant.

Mahonia repens 10″ Zone 5 Creeping Mahonia

Merely a lower growing Mahonia (under one foot), but it does not have the lustrous leaves of the other species.

Pachistima canbyi 12″ Zone 5 Canby Pachistima

One of the evergreen ground covers of merit is this native of Eastern North America. The small leaves, good texture, low, dense growth, and bronze winter color of the leaves, all go to make it a plant that can be featured in the rockery or in the foreground of ericaceous plantings.

Pachistima myrsinites 18″ Zone 5 Myrtle Pachistima

This is the Western counterpart of the Canby pachistima. A relative newcomer to the Arboretum plantings (from the mountains of Colorado), it is too soon to report its growth in this area, although previous experience has shown that it is hardy here.

Pachysandra terminalis 6″ Zone 4 Japanese Pachysandra
Japanese Spurge

Japanese spurge still remains the best evergreen ground cover for shaded situations. Commonly grown in countless gardens throughout the United States, its many good points are well known. The variegated variety does not grow nearly as well in most situations as does the species.

Pieris floribunda 6′ Zone 4 Mountain Andromeda

Professor Sargent used to say that this was one of the very best of the broad-leaved evergreens because it would grow so well in many situations. The upright panicles of small white flowers in late April, the dull evergreen foliage, and its ability to grow in acid and alkaline soils, make it a most serviceable evergreen.

Pieris japonica 9′ Zone 5 Japanese Andromeda

Even better, although not quite so hardy, is the Japanese andromeda, for the lustrous leaves of this species are much to be desired. Also, the flower clusters are slightly larger and pendulous, so that the entire plant is more ornamental than the native species. Both are good in gardens, especially in foundation plantings about the base of the house where they will withstand more alkaline soil conditions than many another ericaceous plant.

Potentilla tridentata 2″–12″ Zone 2 Wineleaf Cinquefoil
Three-toothed Cinquefoil

A very hardy ground cover, this low evergreen is found on the top of the White Mountains in New England, growing in extremely poor, rocky soil. As an evergreen ground cover it is excellent, since it quickly grows into a low, rounded mass of foliage in good soil and seems to withstand the rigorous winters very well indeed. Why it has not proved more popular is hard to say. Once established as a small ground cover in rockery or garden proper, its true value will soon be noted.

Prunus laurocerasus schipkaensis 18′ Zone 5 Schipka Cherry-laurel

For many years, this variety of the cherry-laurel was supposed to be the hardiest and best for New England. Whether or not this is still true, is difficult to say, since we have been trying other varieties, especially *zabeliana*, with equally good results for several years. The vigorous, vase-shaped habit of the Schipka cherry-laurel, its long, glossy, evergreen leaves, and the excellent condition in which cut branches can be kept for lengthy periods in arrangements indoors, go to make this a truly excellent ornamental, one that might well be used far more than it is. However, it will burn in some of the most severe winters, hence it should be used in slightly protected, often partially-shaded situations. Once it is known to a garden-minded "arranger," it will always have an important place in the garden.

Rhododendron arbutifolium 4′ Zone 5
Rhododendron carolinianum 6′ Zone 5 Carolina Rhododendron
Rhododendron catawbiense 6–18′ Zone 4 Catawba Rhododendron
Rhododendron fortunei hybrids 12′ Zone 5 Fortune Rhododendron Hybrids
Rhododendron keiski 8′ Zone 5 Keisk Rhododendron

Rhododendron laetvirens	4′	Zone 4	Wilson Rhododendron
Rhododendron maximum	12–36′	Zone 3	Rosebay Rhododendron
Rhododendron minus	9′	Zone 5	Piedmont Rhododendron
Rhododendron myrtifolium	4′	Zone 5	Myrtle Rhododendron
Rhododendron racemosum	2–6′	Zone 5	Mayflower Rhododendron
Rhododendron smirnowi	6–18′	Zone 4	Smirnow Rhododendron
Rhododendron watereri	6′	Zone 5	Waterer Rhododendron
Rhododendron wellesleyanum	6′	Zone 4	Wellesley Rhododendron

These are some of the evergreen rhododendrons growing well in the Arnold Arboretum. There are many varieties of these species, and hybrids as well. It should be mentioned that *R. keiski* is apparently none too hardy, but it is the only yellow-flowering species growing here at present. All need acid soil, much humus and moist soil conditions to do their best. Gardeners know that slightly shaded situations are sometimes conducive to best growth and certainly less winter injury.

Rhododendron obtusum amoenum	3′	Zone 5 or 6	Amoena Azalea
Rhododendron obtusum japonicum	3′	Zone 5 or 6	Kurume Azalea
Rhododendron mucronatum	6′	Zone 5 or 6	Snow Azalea

These are the only so-called "evergreen" azaleas which survive in the Arnold Arboretum, and sometimes these will be badly injured in severe winters. Consequently, they cannot be recommended as thoroughly hardy for this area.

Teucrium chamaedrys 10″ Zone 5 Chamaedrys Germander

A neat plant, usually thought of as a "sub-shrub," this native of Central and Southern Europe has uses in the garden, sometimes as a low-bordering hedge, very easily pruned; other times, as a ground cover or as a low evergreen in front of taller growing shrubs. There is a variety *prostratum* which is lower in growth. When the tops are injured by exposure or cold winters, they can easily be sheared off just above the ground level and so will easily make a dense mass of foliage.

Thymus serpyllum 1″ Zone 3 Mother-of-thyme
Creeping Thyme

In speaking of evergreens, this diminutive plant certainly must be mentioned. Very popular and widely used, it is the lowest of the evergreen ground covers.

Vaccinium vitis-idaea 1′ Zone 5 Cowberry

This species and its two varieties *majus* and *minus* are included in this list of broad-leaved evergreens. The last mentioned, mountain cranberry as it is often called, is the hardiest, but it should only be used in cool moist mountainous areas where acid soils are prevalent. Hot, dry summers are conducive to its early failure.

Vinca minor 6″ Zone 4 Periwinkle, Myrtle

Some consider this a better ground cover than even the Japanese spurge because it will grow equally well in sun or shade. Some years it is not completely evergreen, losing its leaves in very late winter, but with some protection it can be classed as a most valuable evergreen ground cover. Several varieties are available, with variegated foliage or flowers white or double. 'Bowles' variety tends to grow in one clump, rather than as a trailing vine along the surface of the ground.

Viburnum rhytidophyllum 9′ Zone 5 Leatherleaf Viburnum

In southern Ohio and warmer parts of the country, there are several evergreen viburnums, but here in the Arnold Arboretum, although we are trying to grow others, the only one making a semblance of retaining its leaves throughout the winter is this species. The long leaves are a lustrous dark green and rugose, sometimes as much as six inches long. Slightly shaded situations in New England may assist in bringing it through the winter in good condition.

Donald Wyman